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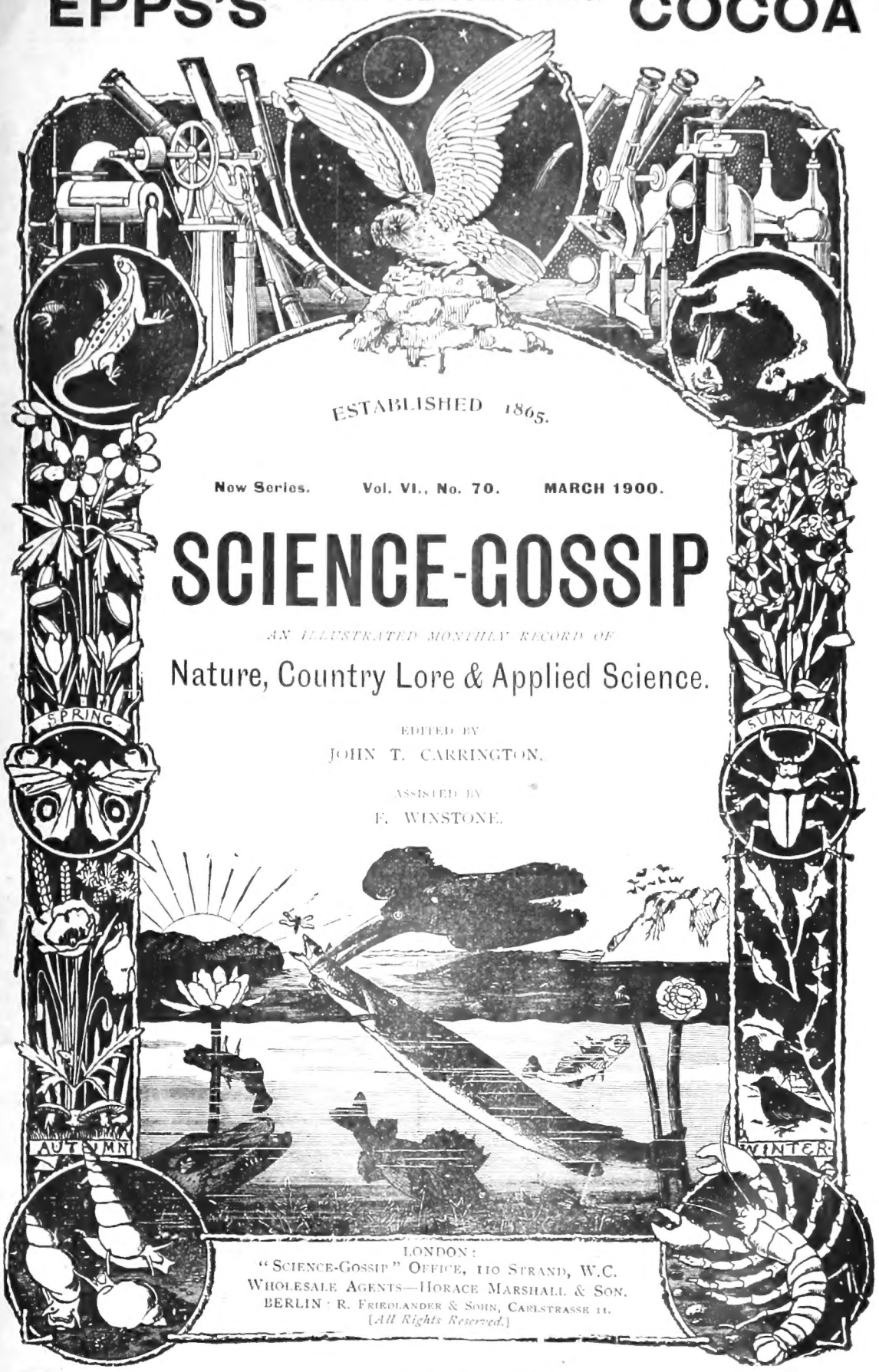

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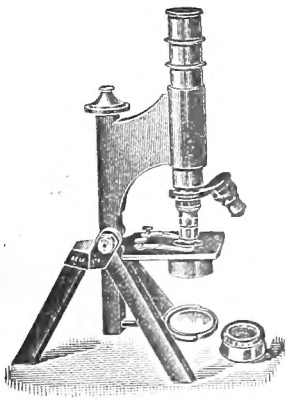

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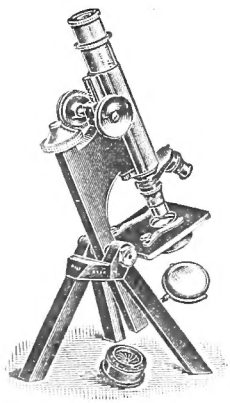

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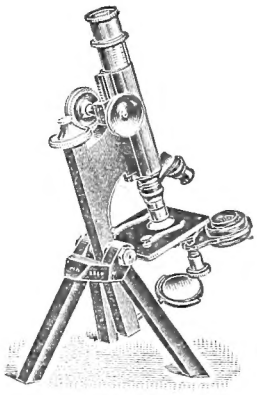

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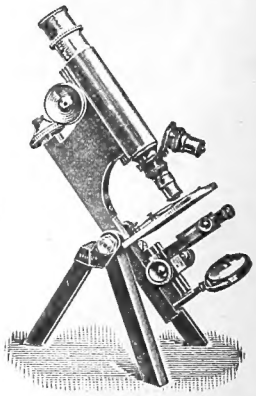

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PHRYGIA AND AN EARTHQUAKE.

By J. Bliss.

IT is only a few years since a journey to the ruined cities of Phrygia which were nearest the coast of Asia Minor seemed a slow one to those accustomed to the means of rapid transit in Europe, or a tiring one to those who were not physically strong. It had to be performed on horseback, with hard fare and often poor quarters at the close of each day's march. Tedious or uninteresting it never was to the lover of Nature or the student of history, for every turn of the road disclosed some fresh feature of beautiful landscape, some group typical of Turkish country life, some old ruin, some wild animal, some new flower, or other interest in the rock formation. The freshness of the early morning start, the neighing of the horses, the vagaries of the armed escort, the halt at the wayside café, and the talk with the grave elders, who never seemed in a hurry, but in reality were burning with almost childlike eagerness to hear news from the Frank, the noon siesta under some wide-spreading tree, the ability to stop whenever bird, beast, or flower tempted one, combined with youth and health, all went to make such a journey delightful. This is now changed with the extension of railways, and while we do not wish to imply that it is not a change for the better, we cannot and do not desire to forget the old ways. We step into the train at Smyrna, and speed over the country past Ephesus, over a pass in the Messogis mountains, into the wide fertile Maeander valley, then on eastwards past Magnesia, Tralles, Nyssa, and Antioch. Here the plain narrows, and at Ortakchai, some eight miles further on, it is only about a mile wide. This is the great western door of Phrygia, having on the north the Messogis mountains, and on the south Salbakos. Both these ranges are separated from the plain by a line of low hills composed of sedimentary rock and gravel. Those on the north side extend from the coast opposite Samos, where they interpose between the Mycale mass and the Messogis to the junction of the rivers Maeander and Lycus, and thence up both sides of the latter valley, a total distance of considerably over a hundred miles. There are numerous springs of hot water throughout these hills, the temperature in the centre of those near Ortakchai being 160° Fahr. The water is sulphurous, and it is much resorted to by natives suffering from rheumatism, paralysis, skin diseases, and indeed from all the ills flesh is heir to, for they have implicit faith in the general efficacy of mineral baths. There are the remains of ancient buildings near by, showing probably that the waters have long been in request. About eight miles beyond the frontier of Phrygia we leave the Maeander valley and enter that of the Lycus, and in seven hours from Smyrna we alight at Gongelli. Our party comprised two ladies, two archaeological friends, and myself.

Hierapolis Cliff, showing Upper Half of Terraces and Basins.

Twenty minutes' walk from the railway station up the banks of the Asopus brought us to the remains of the bridge which once spanned that stream, leading to the western gate of Laodicea. Here our party

separated; one friend and the two ladies followed the Professor to listen to his learned discourse on the ruins of two early Christian churches he had recently discovered there, while I wandered off alone to hunt for molluscs and other beasts. Scorpions were everywhere. Almost every stone turned disclosed one, which scuttled away with tail elevated and sting carefully bent over the last segment. Under and around the stones covering the scorpions were quantities of broken shells of the smaller kinds, *Helix virgata*, *H. pisana*, *H. variabilis*, and others I could not identify. Are there any records of scorpions feeding on molluscs? I think it is probable that they do prey on the small species, whose shells are thin enough to be chipped open by their hard claws.

The most numerous molluscs were *Helix aspersa* and *H. lucorum*, and they were indeed numerous. Every crack and cranny in the ruinous walls contained compact masses of them. Next in number came *Helix variabilis* and *H. virgata*, clinging to the thistles and rank grasses. I also found a number of small lenticular shells not yet identified, and a few *Zonites*, which I think are a variety of *Z. smirnensis* Roth, *Helix cartusianella*, *Buliminus pupa*, and *Pupa doliolum*.

A good deal of the stone used in the construction of the inner part of the walls of this town is of a hard cement-like substance, and is full of casts of a spiral univalve, probably a *Cerithium*, and of a bivalve very like *Cardita planicosta* Lam., showing that a considerable deposit of fossiliferous rock of marine origin exists in the neighbourhood. On searching I found, in a railway cutting to the west of the hill on which the town stood, a formation consisting mainly of sand and rounded boulders, overlying a deposit of the same cement-like stone, though of softer material, containing casts of similar marine shells. Darkness put an end to further search, and taking our seats on a railway trolley we soon shot down to the Gongelli station, close to which stands the small clean hotel, where we found unusually comfortable quarters for the night.

From here the white cliffs of Hierapolis, some six miles away across the Lycus valley, are a striking feature of the landscape, and the mistake modern travellers have fallen into in calling it Bambuk Kalessi (Cotton Castle) is perhaps pardonable, for its cliffs are white as cotton, and are the most prominent feature on the north side of the valley for many miles; its real Turkish name is Tambuk Kalessi. This was our destination on the following day; we passed the Lycus by a shaky wooden bridge, and reached the foot of the white cliffs in a little over an hour from Gongelli, crossing *en route* the great road traversed by Xerxes when on his famous march to Sardis in 481 B.C., traces of it being still visible.

The town of Hierapolis was built on a flat plateau standing some 450 feet above the level of the plain below. Near the eastern end is a beautifully clear pool; the temperature of the water is about 104° Fahr., and it is highly charged with carbonate of lime. It flows by several channels over the edge of the plateau, and, cooling as it falls, precipitates the lime held in solution. This deposit forms a series of irregular terraces, each terrace being composed of semicircular and horseshoe-shaped basins, over the lips of which the water falls, again depositing the lime in stalactites and columns round their outsides. These terraces, stalactites, and columns are pure white, while the water itself is of varying tints of palest blue and green. Strabo says that this water was much used for dyeing in the old times; now its only use, beyond delighting the eyes of travellers, is to drive the wheel of a flour-mill at the base of the cliff and to ease the rheumatic pains of the natives, who resort hither for bathing. The lime, soft and white as snow when newly deposited, hardens on exposure, and in course of time becomes yellowish-grey in colour. The plateau is about two miles long by half a mile wide, and it is an interesting problem whether it has been entirely built up by the deposit from the spring or not; my impression being that it has not. The stones used for the old building are large squared blocks, and are of similar substance to the deposits now being formed. They are hard, and very little weathered, notwithstanding that they were quarried a couple of thousand years ago.

The ladies of our party had no difficulty in climbing the precipitous cliff, as the lime gives good foothold. Arriving at the summit, they again preferred to follow the Professor and hear his learned explanations of the history of the ruined buildings rather than help me in searching for living creatures. They did not lose anything, for my walk was particularly barren of result. *Helix lucorum* and *H. aspersa* were abundant certainly, but no other species of mollusc was to be seen. I expected all the shells would have been ponderous, from the abundance of shell-forming material, but I could distinguish no difference between them and those of the same species found elsewhere.

The only other trace of wild animal life was a pair of eagles soaring over the mountain to the north and a jackal skulking amongst the tombs of the necropolis.

Since our visit a succession of earthquakes has caused great damage to property and a lamentable loss of life throughout the district referred to. The first and most severe shock occurred at 4 A.M. on September 20th last, its centre being near Saraquoi, some ten miles above Ortakchai. All accounts agree in stating that the first sensation was that of a strong blow from the northward, followed immediately by a counter-blow from the south, then a general twisting or rotatory shake. The effect of this was that the major part of the houses, mosques, and churches were ruined throughout a great portion of the Maeander and Lycus valleys. Thus at Denizli out of 4,500 houses, 2,400 were levelled with the ground; at Saraquoi out of 800 houses, 600 were destroyed; at Ortakchai all the houses were down; at Nazli a

great number of houses and all the mosques were down; and the damage extended to all the towns and villages as far as Aidin. The area in which damage to buildings occurred was about 1,600 square miles, and it is estimated from 800 to 1,000 human lives were lost. I have recently revisited this region and thoroughly examined the effects of the earthquakes.

The Maeander valley runs east and west, and one consequence of the earthquakes is that many fissures were formed in the ground, running in the same general direction parallel with the mountains. The chief one extends along the slope of the foot hills on the north side, for a distance of about forty miles, but with interruptions here and there. It varies in width from a couple of feet to a mere crack, and its depth when formed must in many places have been considerable. During the two months which have elapsed since the event it has been considerably filled with rain-washed earth, still I found it to be about 12 feet deep in one place. The ground on the south—that is, the plain side of this fissure—has sunk from 2 to 10 feet below its former level. Other smaller fissures and cracks were also opened in many parts of the plain, some being noted over 100 miles distant from the centre of disturbance. From most of these fissures water, bearing sand and mud, gushed out, which in some cases ceased to flow in the course of a few minutes, and in others continued for several days. The water in many wells rose to the surface and overflowed, then subsided to its former level. It is noteworthy that only those buildings which were situated in the plain were damaged; those standing on the mountains escaped injury.

I am told that many of the hot springs already mentioned ceased to flow for a number of days, and then gradually regained their volume. I visited one hot spring at Kizil Dere, about six miles from Ortakchai, and the volume there was apparently the same as in previous years, the temperature being also as formerly, that of boiling water.

My opinion is that, either as the actual cause of the earthquake or as the result of it, the ground of the whole plain from some few miles east of Laodicea to near the sea, a distance of over 110 miles, has sunk; but to what extent I have no means of ascertaining.

The Turkish,
Smyrna, November 27th, 1899.

LIFE UNDER OTHER CONDITIONS.

By Geoffrey Martin.

BEFORE discussing the possibility of life under conditions other than those now existing upon the earth, we may ask: What is life? Ere the dawn of history this question was taxing the intellect of man, and even now the more deeply we investigate the problem the further off appears the solution.

It may be said, more especially from a biological standpoint, that life is "organised motion." The essential condition appears to be the formation of vastly complex compounds that break up continually, giving birth to new complexes, which in turn break up themselves. In fact the primordial motion of the atoms is so regulated, that there is created a "balance" of motion, complex compounds continually appearing and breaking down again. Before life can exist the external conditions must be such that this balance of motion is capable of attainment.

Of all the terrestrial elements there appears to be but *one* which, under the PRESENT thermal conditions, is capable of generating these everchanging complexes in which this necessary "balance" of motion is attained. This element is carbon, and this is why, AT ORDINARY TEMPERATURES, it forms the basis of life. At ordinary temperatures the carbon atom is tetravalent. In other words, an atom of carbon has sufficient attractive power to control or regulate the motion of four other atoms like hydrogen, or two atoms like oxygen. If the temperature be raised, although the attractive power of the carbon remains, yet the relative motion of the attached atoms is increased and the carbon no longer appears able to keep them together. On the other hand, if we reduce the motion of the attached atoms by lowering the temperature, we get one system of atoms continually combining with other systems of atoms, and thus the compounds grow more and more complex.

Now, conceive of an enormously complex body, whose molecules, if such a compound has molecules in the ordinary sense of the word, consist of system within system of atoms, all in motion, atom circulating about atom and system about system—a molecule so vast and so complex as to be in itself a kingdom. Then imagine the temperature to be very slowly raised; the motion of the intricate streams of atoms in the molecule becomes more and more vehement, until a point is reached where the controlling force is just unable to keep captive the whirling systems, but yet sufficient to maintain and direct an harmonious system of atomic movement within the molecule. Consequently the molecule is continually breaking down. As fast as it breaks down, materials continually stream into the sphere of this molecular motion, circulate in its system, and stream out again. Thus the molecule is constantly replenished. Hence its molecular existence is a continual metathesis, and, as in a vortex ring, the motion when once created

goes on for all eternity—if only the stream of replenishing atoms be maintained and the temperature properly adjusted. It is from some such state of harmonious motion here pictured, and made possible by the presence of jarring atoms of nitrogen which by their changeable attractive capacity render the system so unstable, that in all probability the phenomenon of life arises.

Before life can arise we probably must have (1) an atom, like carbon, which is capable of linking together a large number of atoms; (2) a motion of such an intensity among the atoms as just to overcome the attractive power of the controlling carbon atoms, or system of atoms; (3) a great constancy in the attractive capacity of the central linking atoms, in order that the gliding away of the various systems may be attained as soon as the proper amount of motion, and consequent pull, is reached. These conditions appear to be satisfied by those under which we live.

The temperature of men, and of mammals generally, keeps remarkably constant, and the external conditions are such as to allow this constant temperature to be maintained. Indeed, life in its present form can only flourish between very narrow limits of temperature. It is within these limits only that such complex and unstable carbon compounds can exist in a state of continual decomposition—a state which is essential to the maintenance of life. Above this temperature these compounds break down into more stable forms of matter. Below this temperature the continual metathesis ceases.

Obviously the necessary temperature depends both upon the nature of the central linking element, in our case carbon; and upon, but to an unknown extent, the external forces, such as gravity, to which matter is subject.

Looking around among the compounds of carbon, we are struck with the number of its compounds which are liquid or semi-liquid, at ordinary temperatures or at the temperature of the blood. This fluidity of the carbon compounds, combined with the great atom-combining power of carbon, is in all probability the reason why, under ordinary conditions, carbon is the central or determining element of the animal organism. At higher temperatures the volatility of the carbon compounds would be so increased as to render impossible the existence of a complex carbon compound in a state of continuous change. While at very low temperatures the motion among the constituent atoms of these carbon compounds would be so reduced that the peculiar and fixed attractive power of the carbon atoms would render any breaking away impossible, and then the compound would become stable. In either case life would be impossible.

The temperature of animal life, then, is the transitional or critical temperature at which a large number of unstable carbon compounds are capable of momentary existence, a higher temperature rendering their existence impossible, while a lower temperature would make the compound stable. One must be struck with the large number of important changes which occur among organic carbon compounds between the small range of temperature 10° to 90° C., and it is obvious that this fact must have some deep and fundamental connection with the phenomenon of life.

Conceive now the temperature of the earth and all objects thereon lowered by say 300° C. How would the carbon compounds appear to the eye of man? They would be hard, and in many cases transparent or translucent solids; in other cases, opaque. They would, in fact, appear to us as the silicates now are, vast complex bodies having exceedingly high molecular weights. We should probably be entirely ignorant of the inner working of the carbon compounds. We might indeed notice that when (say) acetyl chloride and many organic compounds are heated up to what would appear a red heat, the organic compound is attacked. Such reactions, however, would possess no more significance to the chemist living at that low temperature, than the fact that lead oxide attacks siliceous matter at high temperatures has for us.

This property carbon has of acting the rôle of the fundamental element in the animal organism is then probably a mere function of the temperature, and greatly dependent upon the fluidity of its compounds at this temperature. We are therefore justified in asking whether there is any other element which at some other temperature could play the part at ordinary temperatures like carbon in organic matter?

Silicon is such an element.

Silicon, like carbon, possesses a high and constant valency. There is, indeed, a great similarity between the compounds of carbon and silicon. The number of complex double-oxides of silicon is innumerable. True, we cannot effect the synthesis of these compounds and determine their constitution as in the case of the complex carbon compounds; but in great measure this is an accident of temperature rather than anything else. If we could work at a temperature of 700°–1000° C. as easily as at the normal temperatures, there is little doubt that a great flood of light would soon illuminate this portion of our science. We might indeed shortly be able to generate a "Chemistry of the Silicon Compounds." There is, however, one great distinction between silicon and carbon. Carbon expends its energies in forming a series of hydrides and their derivatives. Silicon equally vigorously spends its energies in producing double oxides. There probably, indeed, exists for silicon as for carbon a transitional temperature above which very complex compounds would be incapable of existing, while below this temperature the compound would become stable. At the transitional temperature complex compounds would be capable of a continual metathesis, and thus give rise to the phenomenon of life; only in this case all forms of life would have as the determining element not carbon, but silicon. Seeing that in the case of carbon this temperature occurs when many of its compounds are in a semi-fluid condition, or at any rate near their

decomposing point, we should expect the corresponding temperature for silicon compounds to occur when they, too, are in a pasty or semi-fluid condition—that is, at a bright red or even a white heat.

From first principles, indeed, it is very improbable that life could exist only within such narrow limits of temperature as are at present prevalent upon the earth. Out of the infinite time that has passed before the world cooled to its present state, and the ages that still must run ere the world reaches the absolute zero of temperature, is it to be imagined that during only an infinitesimal portion of this time could organised life exist? To assume that this is the case is to place oneself in the position of those early astronomers who held that the sun and stars and the infinite universe revolved about the earth as centre. Again, there exist in space numberless vast planets and dark suns, whose physical conditions differ widely from those which hold sway upon the earth. Are these entirely void of life?

I must confess that researches on the behaviour of liquids and gases when subjected to enormous pressures and temperatures have always possessed for me a deep significance, on account of the great part substances under such conditions played in the early history of this globe and their possible bearing on the phenomenon of life. Andrews observed that when liquid carbon dioxide is gradually heated in a sealed tube to 31° C., the surface of demarcation between the liquid and gas loses its curvature and at last disappears. The space is then occupied by a homogeneous fluid, which exhibits, when the pressure is suddenly diminished, or the temperature slightly raised, a peculiar appearance of moving or flickering striae throughout its entire mass. At temperatures above 32° C. no apparent liquefaction or separation into two distinct forms of matter can be effected, even under a pressure of 300 or 400 atmospheres. There exists for every liquid a temperature called by Andrews the "Critical point," above which no amount of pressure is sufficient to retain it in a liquid form. (See interesting discussion in Preston's "Theory of Heat," pp. 372–398.)

It is obvious that at this transitional point the molecules are in a very sensitive state, and it may be easily conceived that under such enormous temperatures and pressures as held upon the earth, a very complex mixture of liquid compounds might be capable of generating these indefinite and transitional compounds, which, as has been hinted, may exist in a state of continuous decomposition analogous to that exhibited by the formless and structureless protoplasm. It is obvious that fluidity has much to do with life. All observations in Biology tend to show that the earliest forms of life generated in the fluid sea and spread thence to land.

In the same way when the earth was in great measure one large ocean of fluid siliceous matter, could not forms of life generate in this sea also, life thrilling in siliceous not carbonaceous matter?

As to this purely chemical view of life I would refer the reader to Huxley's essay "On the Physical Basis of Life," where the matter is argued with convincing clearness. Let me quote his words: "If the phenomena exhibited by water are its properties, so are those presented by protoplasm, living or dead, its properties. If the properties of water may be properly said to result from the nature and disposition of its component molecules, I can find no intelligible ground for refusing to say that the properties of protoplasm result from the nature and disposition of its molecules."

Once I had a vision of the beginning of life. I saw the world a vast ocean of liquid fire: above, black driving vapour and vast clouds of steam; below, the bubbling molten rocks. Down in the depths of that molten sea there was a great heat, a heat unthinkable and inconceivable. I saw that here the atoms no longer attracted each other, but yet the pressure was so enormous that they were crowded together as in a liquid. Slowly, through the ages, the world cooled. As I watched I saw the formless mass stir and thrill with new kinds of motion, and I knew atomic attraction had commenced. Feeble compounds flickered into existence in the vast depths and floated, suspended for a moment, and again dissolved to liquid fire. As matter cooled the molten mass became clouded, with innumerable multitudes of such indefinite forms which faded even as they came. In my vision I fancied they were the precursors of the coming life, and perceived that during this infinite period of slow cooling and under these enormous pressures all kinds of combination and atomic motion were possible.

As I watched the atoms gathered together, and again there sprang into existence another formless compound. I looked for it to decompose, but saw, to my surprise, that though it continually broke down as did the others, yet the motion of its atoms and the surrounding conditions were such that fresh matter was constantly drawn into the molecular vortex and continued its existence. The compound grew and grew, decomposing even as it grew, but gathering in, continually, fresh matter from around. As it became unwieldy it lost its cohesion and separated into masses, which again, in their turn, grew and separated. I now perceived this was the beginning of life. Meanwhile, the world cooled and stable compounds appeared. Yet this never-ceasing motion of the atoms continued, and drew other elements into the molecular vortex of these primeval forms of life, and they displaced the older elements, with fall of temperature, ever producing fresh types. Some of these were caught up into the thick fluid vapours which swept along the molten surface, and, as the ocean slowly condensed as vast boiling masses impregnated with liquid mud, found a fresh lease of life in its fluidity. The rest died with the falling temperature, and their bodies blended with the molten rock, as a jelly-fish dies and blends into the infinite ocean of salt water, so that none can know hereafter that it has been and gone.

Redland, Bristol, December 1899.

THE PTILINUM OF DIPTERA.

By W. Wesché.

OF the extraordinary and the apparently ingenious in Nature, there is no end. No limit can be placed to her resources or to her inventiveness; almost every mechanical law has been adapted by some plant or animal, every philosophical principle applied. The orchid has used the catapult and the sucker to fix pollen on the body and head of the visiting insect; the dandelion, the parachute to scatter its seeds; the bombardier beetle, the chemistry of explosives to frighten its pursuing enemy; the eel, electricity for defensive and offensive purposes; the bees and the wasps, a nicety in the use of poisons that our most learned toxicologists must vainly hope to emulate. It is not generally known however, that our familiar flies avail themselves of pneumatic force to escape from their pupa cases: yet such is the fact with a large number of the families of Diptera.

Baron Osten Saken has arranged the order Diptera into three sub-orders—the Pupipara or degraded forms, the Cyclorhapha or those having a circular opening to the pupa case, and the Orthorhapha or those having a T-shaped opening—which is further subdivided into two sections, Brachycera, consisting of flies having short three-jointed antennae, and Nematocera, of those having many-jointed antennae. Mr. Verrall, whose list of British Diptera is, I believe, the only one in any degree complete, and whose arrangement is more generally used by British collectors, begins at the other end, but includes the Pulicidae or fleas, which Professor Packard places in a separate order, Siphonaptera. The Pulicidae head the list of the Orthorhapha, and the degraded forms are at the end of the Cyclorhapha.

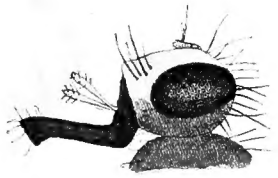

Fig. 1. Head of *Scatophaga lutaria*.

Many of the flies of the sub-order Cyclorhapha are furnished with the ptilinum. It is a membrane on the head, situated on that part immediately between the occelli and the antennae. This is capable of inflation until it takes a nearly spheroidal shape, and projects, expanding to about half the size of the head. By this means, without any struggle of the limbs, the perfect insect pushes off the cover of the circular aperture of the pupa case. There are, however, certain families that are without the ptilinum, though they are included in this sub-order; those flies who have nearly the whole head covered with eyes, as *Pipunculus* and *Syrphus*, and the less-known though well-marked families of Phoridae and Ephydridae. On the other hand it is very distinct in *Melophagus ovinus* (sheeptick), and I find traces of it in *Braula caeca* (bee-louse). Both these parasites are degraded forms, and belong to the sub-order Pupipara.

It is unfortunate that no trace of this apparatus is visible on the insects as they usually appear when pinned in our cabinets. Preparation for the microscope is necessary to show it, as otherwise it would be of considerable service in classification. The common dung fly, *Scatophaga stercoraria*, shows the ptilinum admirably, and is easily obtained. *S. lutaria* does equally well, and the accompanying drawings are made from that species.

Fig. 1 shows a drawing of the ordinary appearance of the head as seen from the side. The eyes, bright red in life, become quite dark; the general colour is a shade of olive-green, and the facies, the space between the eyes, is an orange-yellow.

Fig. 2. Head of *S. lutaria*, showing membrane forming ptilinum.

Fig. 2 shows the top of the head viewed from above, with the occelli placed on the curious triangle which in *Scatophaga* juts out on to the orange-coloured facies, which is the membrane of which the ptilinum is formed.

Fig. 3 shows a head, prepared for the microscope and mounted, under pressure. The pressure expands the ptilinum, which is seen to project as if inflated. In life, after use, it is wrinkled up into many folds, and remains in that condition. Sometimes it fails to expand when mounted, remaining in this state; but from the peculiar structure of its surface it is easily detected by the microscope with a magnification of 250 diameters.

Fig. 4 shows a portion of the ptilinum more magnified. Its surface is seen to be covered with a number of minutely pointed angular scales. These on the expansion of the membrane, which is probably in some degree elastic, become erect. These scales vary in appearance and size in different

families. Their use here is not very apparent, as they seem too small to be of service in breaking and scraping the comparatively hard surface of the pupa case. A similar structure is to be found on the ovipositor and genitalia of some Diptera, Apidae, and Coleoptera, where it is probably for sensory purposes. This fact rather confuses than

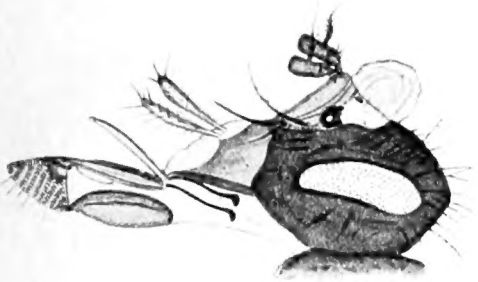

FIG. 3. Head of *S. lutaria*, showing ptilinum expanded.

throws light on the uses of the structure when placed on the ptilinum.

On the sides of the thorax of *Stomoxys calcitrans*, the familiar blood-sucking fly, between the fore and middle legs, on that part of the thorax technically known as the meso-epimerum, are two patches of this characteristic membrane, though not quite identical under a power of 350 diameters with that on the head. I believe these have not been before noticed, and are indeed difficult to make out. They show well enough on a cleared and mounted insect, but only appear as a darker spot on the body when examined as an opaque object. They are about the same size as the spiracles, though totally different in appearance. It has been the custom of observers on finding an organ whose use is not apparent to class it as auricular. The comb on the fore tibia of many Hymenoptera, used for cleaning the antennae, was explained thus, and it is possible that these may be for auricular purposes. That being so, one would

FIG. 4. Minute scales of ptilinum.

expect to find it on nearly related species. I have carefully examined a number of Muscidae, but failed to find it; therefore, arguing from analogy, I am inclined to think that they are used in the same way as the ptilinum and for the same purpose, and add another complication to the anatomy of this already highly specialised insect.

90 *Belsize Road, South Hampstead, N.W.,*
February 2nd, 1900.

NOTES ON WOODLICE.

BY WILFRED MARK WEBB, F.L.S.

THERE is no doubt that among crustaceans the woodlice are very much left to themselves by naturalists in this country. Here and there, however, one finds that some trouble has been spent upon these creatures, and quite recently a paper dealing with them was read before the North London Natural History Society by Mr. James B. Casserley. It is mainly to record some facts brought forward in this contribution that the present article has been written.

Of greatest interest are the remarks with regard to *Armadillidium vulgare* Latreille, based upon notes made daily from June to December 1897. For some weeks the developing young could be seen through the wall of the brood-pouch formed by plates on the under side of their mother, in which the eggs are carried about after they are laid. On July 18th a brood was found struggling about among the lumps of mould in the breeding-cage, each individual being about the size of an ordinary pin's-head. Smaller parents, it was noticed, had proportionately smaller offspring. As soon as they had quitted the brood-pouch, the young woodlice began to run about briskly, and were able to roll themselves up into balls in exactly the same way as do the adult members of their particular species. They were white in colour, and apparently resembled their parents in structure, save that while the latter have seven pairs of walking legs, the former had but six pairs. Owing to the cannibalistic propensities of the older woodlice, Mr. Casserley was not able to observe the first moult, after which the seventh and hindermost pair of limbs is found to be present.

The conclusion that was arrived at is that woodlice must live a considerable time. During the six months that they were watched, no individual changed its skin more than once, and the increase in size after moulting was so slight as to be but barely perceptible. It is only reasonable to think that a long period will be required, under these circumstances, for a creature the size of a pin's-head to grow to a length of three-quarters of an inch. It is worthy of note too, that *Armadillidium* goes on growing after it is sexually mature.

The larger the animal the darker is its hue, until a length of the third of an inch has been reached; then the characteristic slaty-black colour is acquired. Mr. Casserley is at a loss to explain the variation that occurs in the number of the green spots that were distinguished on the dorsal surface of every specimen, with the exception of one or two large ones. Two examples of the same age would change their skins at the same time, says the observer, and after moulting one might have the number of decorations nearly doubled, on the other very few could be seen.

The following description of the process of

moulting is given in Mr. Casserley's own words :— "The first sign of the approaching change is the appearance of a white border to each segment of the body, which gradually becomes more marked. The animal by this time is much less active, and usually forms a small burrow to rest in. If it does chance to leave this, it is only for a short time, invariably coming back again to the same place. In some cases no burrow is formed at all, a sheltered corner against a stone being protection enough in the creature's opinion ; but each woodlouse keeps to the place it originally selected.

"Ten days more or less after the white lines on the edges of the plates have become visible a very curious change is apparent—the animal appears to be divided into two. As is well known, there are seven leg-bearing segments, and the first four of these and the head appear as if they had coalesced to form one large segment, while the remaining three and the abdominal divisions have done the same. The original segmentation can of course still be made out ; but the joints are all fixed, with the exception of that between the fourth and fifth leg-bearing segments, which remains movable.

"The woodlouse continues in this state for from one and a half to two days, and then, suddenly walking forward, frees itself from the covering of the hinder portion of its body, carefully drawing the last three pairs of legs from their old skin. The part thrown off is perfectly white in colour, and is a very pretty object indeed ; the jointed casings of the legs being beautifully perfect, and made up of delicately thin glass-like substance. As is usual, the lining of some internal tubes are cast with the skin. Just before this throwing-off of the parts mentioned, the whole body seems to swell and take on a light blue colour.

"Having got so far the woodlouse, after putting his somewhat tender half well into his corner or burrow, proceeds to make a meal off his cast skin. He now has a very odd appearance. Excepting that the white edges are most marked, the front part of his body retains its original form, size, and colour ; while behind he is of a light slaty-blue, very soft, and in proportion a little larger. After three days or so the tail end has become fairly hard, and attained the normal colour ; then the skin of the front half is pushed off. At this stage the animal is in the most precarious condition in which he ever finds himself. All his fighting parts are soft and defenceless, and any of his species that happen to be near make a feast off him, eating all the front half and rejecting the now hardened tail end.

"Supposing the moulting woodlouse to have escaped this danger—and in captivity only isolation from his fellows will give him a chance—in about three days his jaws are sufficiently hardened to allow of his eating something, which is always his old clothes, as in the first half of the moulting process. In young specimens the operation does not occupy quite so long a time. Specimens half an inch long do not moult oftener than once in six months, and but little increase in size is noticeable after the process."

Mr. Casserley alludes to the way in which the woodlouse passes the winter. It can hardly be said to become torpid ; but when cold weather comes on, it remains exactly as it happens to be. If left alone, and there is sufficient moisture, it will not move at all until the temperature is raised. On the slightest disturbance the animal becomes quite as lively as in summer-time for a few minutes, and then settles down again.

As to the daily life in captivity of the creatures under discussion, it was found that they are inclined to be quite still during the morning, and it is not until about five o'clock in the afternoon that they move about much. As night approaches their liveliness increases, until they walk about quite rapidly. Each individual chose some particular part of the cage in which to rest during the first part of the day, to which it invariably returned, never usurping that of another.

Mr. Casserley had something to say with regard to centipedes and millipedes, and concluded with remarks upon his observations. He seems to have somewhat suddenly given up the work, which is a great pity, seeing that there is so much to be done, and that he had not succeeded in seeing the first moult of the young woodlice. For the benefit of those who may be inclined to interest themselves in our terrestrial isopods, I may add something with regard to the number of British species of woodlice. Dr. Scharff ("Irish Naturalist," vol. iii. pp. 4–7 and 25–29) gave brief descriptions of seventeen species in 1894. Last year the Rev. Canon Norman ("An. Mag. Nat. Hist.," ser. 7. vol. iii. pp. 70–78) enumerated twenty species, and in the current number of the "Essex Naturalist" (vol. xi. p. 127) the present writer records an additional one. Hence the number of known British species is twenty-one.

In conclusion, the writer wishes to say that he would be glad of any specimens of woodlice that those interested in the subject may feel disposed to send to him. The specimens, small and large alike, should be put into methylated spirit directly they are captured, and the containing tubes or bottles, which should not be large, enclosed in a tin box for transit. The habitat and locality should in all cases be noted.

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(*Continued from page 266.*)

PARNASSIUS (*continued*).

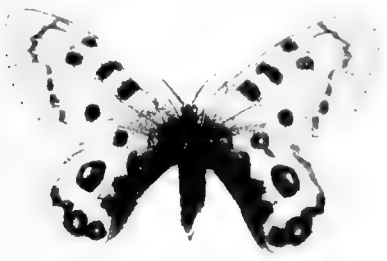
Group 6. Limbati Aust.

The abdominal pouch in this group has been alluded to on p. 171. There is only one species.

22. **P. tenedius** Eversm. Bull. Mosc. 1851. Aust. Parn. 129, 175, pl. 13, fig. 3.

50—57 mm.

The ground colour of the wings is pure white. F.w. with three distinctly black subcostal spots and an ante-marginal band of round black spots arranged as in *P. apollonius*; the spot near the in. marg. is represented by a black dot. H.w. In. marg. narrowly deep black; a faint trace of a red basal spot; the black row of ante-marginal spots is continued as in f.w. Costal and central red spots present, but small, and there is a small black dash on the outer



P. szechcni.

edge of the disc. cell not seen in any other species. U.s. h.w. with traces of three basal spots of a whitish colour bordered with black, two red centred spots near an. ang.; the other markings as on upper side, ♀ rather less clear white, the outer subcostal with two small red spots. H.w. with a row of four red centred spots internal to the ante-marginal black ones, and extending nearly from in. marg. to the second median nervure. U.s. of h.w. with the basal spots distinctly red; the rest of the pattern as on upper side.

Hab. Amur VII.; Eastern Altai IV., V. Olekminsk on the banks of the Lena, and in Daouria, Central Siberia VI. Not at great elevations.

Group 7. Ventricosi Aust.

This group contains more diversity of forms than any of the preceding ones. The Palaearctic species fall into three sections.

Section A consists of *P. nordmanni* and *P. clarius*. Both these species have general appearance of Group 1. The wings are white with the markings seen in that group, and with well-marked red or orange spots. Elwes, in writing of *P. clarius* which he took on the Tchuja Steppe, says: "I did not distinguish this from *delius* by its flight or appearance till I had the female in my hand, when the pouch at once showed what it was." (Trans. Ent. Soc. 1899, III. 314.) Neither *P. clarius* nor *P. nordmanni* have any red basal spots on u.s. of h.w.

Section B consists of *P. eversmanni* and *P. felderi*. Both these species agree in the canary yellow colour of the hairs which invest the body, especially on the thorax and ventral surface. Both species have red basal spots on the u.s. of h.w. This character is very faintly marked in *P. felderi*, which seems to form a transition to the third section.

Section C, consisting of *P. mnemosyne*, *P. stubbendorfii*, and *P. citrinarius*, species within which there is no trace of any red markings. In the two latter all the markings characteristic of *Parnassius*, except the basal shading on h.w., are absent or nearly so, the insects having a superficial resemblance to Pierids.

The common character of this group is the peculiar formation of the abdominal pouch as shown in the figure of that of *P. stubbendorfii* on p. 171.

23. **P. clarius** Eversm. Bull. Mosc. 1843, III. 539. Aust. Parn. 147, pl. 20, fig. 1.

60—64 mm.

Wings white, f.w. with distinct marginal and ante-marginal bands. The latter are long and wavy, reaching nearly to an. ang. Three subcostal spots, the two internal ones deep black, the external grey and semi-transparent. No red spots on f.w. Base not shaded. H.w. with ou. marg. plain white, or with a faint trace of a dentate pattern. Basal black shading distinct, shaped much as in *P. actius*. Near an. ang. a variable black spot occasionally faintly marked with red. U.s. as above, but glazed and with less distinct markings. H.w. as above, without any basal red spots, but with the spot near an. ang. marked red. The red colour of the markings in this species is a bright scarlet, sometimes inclining to orange.

Hab. Saisan (Central Asia), Siberia, Altai, Tarbagtai; also in California. In the Palaearctic region it seems to be confined to the Altai region, and does not occur in the Amur or in the Tianchan Mountains.

a. var. *dentata* Stgr. in litt. Austat. Parn. 149, pl. 21, fig. 1–2. Differs from the type in having a distinct dentate pattern along ou. marg. h.w.; it is at best an inconstant variety, and all degrees of variation between this and the type occur. Hab. Saisan,

s. of Tarbagtai, Cent. Asia (Austat.). Elwes states that it has been taken in the E. Altai.

24. **P. nordmanni** Nordm. Bull. Mosc. 1851, II. 423. Aust. Parn. 132, Lg. B. E., p. 19, pl. IV. 3.

55—57 mm.

Differs from *P. clarius* in the narrower shape of the wings, and in the ground colour being of a more yellowish white, in the absence of the third or external subcostal spot on f.w. The submarginal band is merged into the marginal, so as to form one, this being broadest towards the costa and terminating towards the centre of the wing, forming a grey, semi-transparent, apical blotch, rather than a band. H.w. without any trace of marginal dentate markings, basal black shading less extensive than in *P. clarius*. The spot near anal angle wanting. Costal and central spots very light red or orange. U.s. as above, but with a glazed surface.

Hab. High mountains in Armenia and Georgia, on the Asiatic side of the Caucasus. VII. Rare in collections.

This species is figured in my "Butterflies of Europe." I am now quite aware that I ought not to have given it as European; but it must be remembered that during the last twenty years our knowledge of the genus *Parnassius* has greatly increased.

a. var. *minima* Honr. B. E. Z. 1885, p. 272, pl. 8, fig. 2. Aust. Parn. 132, pl. 22, fig. 1–2. 40—45 mm. Differs from the type principally in its smaller expanse. The wings are purer white. F.w. with a slight trace of the external subcostal spot. H.w. with the basal shading carried up more along disc-cell, and with a trace of a black spot near an. ang. Hab. Caucasus. VIII.b. Seems to be much commoner than the type. Dr. Staudinger has sent me a form which he names *minor*, intermediate between the type and var. *minima*, from the Caucasus.

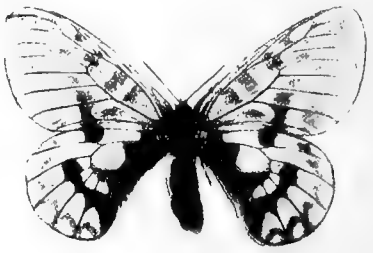
25. **P. eversmanni** Mén. Mus. Petr. 1855, p. 73, pl. I. fig. 2. Aust. p. 133, pl. 20, fig. 2.

55—57 mm.

♂ with the ground colour of all the wings of rich light chrome yellow in place of white. Marginal band reaching the entire length of the ou. marg. Grey and semi-transparent. Internal to this are two perfectly distinct parallel bands of greyish black, reaching from costa to in. marg.; there are three subcostal spots, the two external ones reaching beyond the disc. cell to the centre of wing. Base shaded with black. H.w. with basal and in. marg. shading, as in *P. clarius*. Marginal indentations as in *P. dentata*. Red spots well defined, a large black, irregular spot at an. ang. with slight traces of red marking. ♀ Ground colour of wings white (Wosnesenskii). Markings as in ♂, but more pronounced; central red spot on h.w., joined by a narrow black band to spot at anal angle, which is very distinctly marked with 3 red spots. Abdominal pouch white, like that in *P. mnemosyne*. Neuration in both sexes black. Antennae black, with pyriform clubs.

Hab. Nik (Amur), Kausk (W. Siberia), Poderka, Vilui and Vitim Rivers (Siberia), Darkoti Altai (Elwes), at an elevation of 7,000 feet. VII.

Larva on *Corydalis gigantea* (Graeser).



P. eversmanni

26. **P. felderi** Brem.-Lep. Ost. Sib. 1864, p. 6, pl. I. 5. Aust. Parn. 143, pl. 19, fig. 2.

60—70 mm.

A much larger species than the last. Ground colour white, not yellow. Wings very thinly covered with scales. Neuration black. F.w. markings somewhat as in last, but the ante-marginal band is often very slightly represented, a band corresponding to the middle one in *P. eversmanni*, sometimes runs from the external subcostal spot to the centre of in. marg. to meet the in. marg. spot, but this is not constant; there are only two ill-defined spots internal to this, placed in the disc. cell; base scarcely, if at all, shaded. H.w. white, without any sub-marginal band or marks. Base and in. marg. narrowly deep black, but less extensively so than in *P. eversmanni*. A black spot near an. ang. as in *P. clarius*. Costal and central spots small and generally without any red markings, very rarely with a faint trace of red in centre. U.s. of f.w. as above, but very indefinite, the markings of the upper surface showing through the wing texture. H.w. with red centres to the spots, sometimes in the form of red rings. Basal red spots very faint, being clouded over with bright yellow, which is the colour of the ventral surface of thorax and abdomen. Antennae black with elongated clubs.

Hab. Amur, Bur., V. and VII., Radd. VII.

Larva on *Corydalis*. (R. and H.)

ab. *atrata*, Graeser, R. H. p. 113. A melanic form of ♀. Hab. Radd. Amur.

27. **P. mnemosyne** L. Syst. Nat. X. 465. Aust. Parn. 155, pl. 23, 1, 2. Lg. B. E. p. 20, pl. IV. 4. V. 7 (Larva).

54—63 mm.

Wings white, without any red spots, either above or beneath. F.w. with two deep black subcostal spots, one at the external end of the disc. cell, the other in its centre. Bases not shaded. A short

marginal band reaches from the apical end of costa to the centre of the ou. marg.; this is semi-transparent, and is bisected by a row of very indistinct white spots. H.w. with the in. marg. black, as in *P. felderi*. The costal spot is absent, but there is generally a central spot, dusky in centre and more or less quadrate in shape. The neuration is black. Antennae black with elongated clubs. Head and thorax black; abdomen with whitish hairs on upper surface; it has a narrow lateral line of yellow. ♀ somewhat larger than ♂. Markings less black. F.w. with a trace of a short subcostal band external to the black spots, and also a trace of a dark spot in centre of in. marg. Abdomen blacker and less pilose than in ♂. Furnished with a large whitish pouch. U.s. as above, but with less distinct markings.

Hab. Central, Eastern and North-eastern Europe, N. Scandinavia, Asia Minor, Armenia. Frequents mountain slopes at a moderate altitude, at about 3,000 feet in many places in Switzerland; rather higher in the Basses Alpes, Alpine meadows, in Germany, &c. Not uncommon, but very local. VI., VII.

Larva. Smoky black, with darker spaces between the segments; on every segment are two reddish yellow spots. Legs black. On *Corydalis halleri*. IV., V.

a. ab. *melaina* Honorat. Larger than type, and resembling it in ♂, but ♀ has all the wings suffused with dusky shading, giving it a deep smoky appearance. Hab. The Bavarian Alps and Carinthia, at about 4,000 ft. VI.e.

b. var. *nubilosus* Christoph. Aust. Parn. pl. 23, fig. 3, 24 fig., differs from type in the more extended inner marginal markings in the ♂, which is much like the ♀ of the type. Hab. N. Persia. Some of the German specimens apparently belong to this variety.

c. var. *gigantea* Stgr. S. E. Z. 197, 198. Aust. Parn. 159, pl. 24, 2, 3. 70 mm. Larger and whiter than type, wings more opaque, f.w. with spots large and black, marginal and ante-marginal bands distinct. H.w. with spots large and well defined. Hab. Turkestan, Samarkand, Margelan. V.e. VI.

d. var. *ochracea* Stgr. Ground colour of wings tinged brownish ochre colour. ♂ resembles type in markings. ♀ more suffused with dusky, and with the spots of h.w. coalescing to form a central band. Hab. Turkestan.

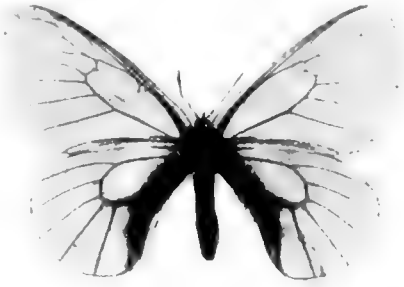
28. **P. stubbendorfii** Mén. Mem. Acad. Petrop. 1848. Aust. Parn. 161, pl. 22, fig. 3.

50–53 mm.

Resembles *P. mnemosyne*, but all the spots on f.w. and h.w. are absent, and the only black markings are the dark shading along the in. marg. of h.w. The neuration is very distinct and black, the wings are very thinly clothed with scales, so as to be semi-transparent. Antennae, head, thorax, and abdomen, black, the latter without yellow stripes. In some specimens there is just the merest trace of marginal and sub-marginal border in f.w. and a slight indication of the subcostal spots, but these are generally absent. Abdominal pouch in ♀ much as in *mnemosyne*.

Hab. Central, Eastern and Southern Amur. Altai. "Common on the Kurai Pass on July 25, at 6,000 to 7,000 ft. The males only flying on marshy Alpine meadows below steep rocks, with *eversmanni* and *delius*. The only two females I took were much lower down in a swampy larch forest." (Elwes, Trans. Ent. Soc. pt. III. 1899, p. 314.)

Larva said to be reddish brown with yellow spots and stripes, and found on *Corydalis gigantea*.



P. stubbendorfii.

a. var. *melanophia* Honr. B. E. Z. 1885. Aust. Parn. 196, pl. VIII. fig. 1. This is a dusky melanic form, in which the wings are suffused with dusky coloration in both sexes. (Conf. *P. mnemosyne* ab. *melaina*.) Hab. Amur. (Wlad. and Nik.)

29. **P. citrinarius** Motsc. Bull. Mosc. 1866. *glacialis*—Butler. *stubbendorfii* var. Stgr.

This *Parnassius* is inserted here as it has several times been recorded from Corea. Apparently quite distinct from *P. stubbendorfii*. Leech's description in "Butterflies from China, Japan, and Corea," p. 506, runs:—"*P. citrinarius* is uniformly larger, but not so rounded in the wing as *P. stubbendorfii*. The ground colour is yellower, and there is always a distinct collar. Under surface of the body is more strongly marked with yellow. In the ♀ the pouch is much shorter and far darker in colour; almost black, in fact. Some well-marked specimens have a superficial resemblance to faintly marked *P. felderi* Brem."

With this species we conclude the genus *Parnassius*. I have endeavoured to give in the fewest possible words an account of the Palaearctic species as they are known up to the present date. There is no doubt that as time goes on many more species will be added to the list. There are numerous parts of the mountains of Asia which are yet unknown to entomologists, and this genus, together with the genus *Colias*, so characteristic of the Palaearctic Region, is sure to be further enriched as the country is opened to travellers and fresh explorations take place.

With this genus we close our consideration of the Family Papilionidae.

(*To be continued.*)

SOCIOLOGY AND SCIENCE OF BABYLON.

SOME eight thousand years ago the dawn of human civilisation is said to have broken in Babylonia. This is doubtless true in a sense, because we have now available abundant records written and dated as early as six thousand years before the birth of Christ; memoirs of the people who then lived on the fringe of the plain drained by the great rivers Euphrates and Tigris. That some form of civilisation had existed, probably for thousands of years before these early human documents were written, there can be no doubt, as the art of writing, either pictorial or by arbitrary signs, was one of man's later accomplishments.

Considering the tone and subjects dealt with in the earliest discovered documents, there does not appear to be any reason why man should not have been partially civilised for ten or twenty thousand years before he commenced to write. Everything, indeed, tends to point to this having been the case, for very shortly after the system of definite writing grew out of the pictorial, we find records of a social system differing in principle but little from that of our own in this last year of the nineteenth century after the birth of Christ.

The charmingly written book by Professor Sayce of Oxford,[1] which forms the first of the "Semitic Series," edited by Professor James Alexander Craig, of the University of Michigan, will come as a revelation to many of his readers who have known only the usual narrative of the age of man. Yet the story unfolded by the Babylonian and Assyrian tablets found during the past few years is so simply convincing that we cannot come to any other conclusion with regard to man's antiquity. These tablets have been long known, and there is already a considerable literature devoted to them and their translation. So far as we are aware, however, the first popularly written work on the subject, gathering together the latest information divulged by their translation, is the book before us.

Babylonia, referred to in the book of Genesis as Babel, was situated on the plain formed by the deposits brought down by the rivers Euphrates and Tigris, that once flowed separately into the Persian Gulf. Consequently the substratum is of clay. To this accident of environment we of the present times are thankful, otherwise it is improbable that we should possess the indelible evidence of those ancient times. Naturally, where stone and even wood were scarce, the people used clay for most of the needs to which it was suited. Their houses were built of brick, their household utensils were made in a corner of the brickfield, and flat tiles or tablets of soft clay were used for writing upon with a stylus. At first they were sun-dried; but later, as civilisation advanced, kiln-baked. Hence it is that these tablets have come down to us uninjured, whereas almost any other substance would have so far decayed as to have lost the sharpness of the cuneiform signs representing the letters. Most of the tablets are of small size, easily carried, and useful for correspondence. Indeed, as our author points out, many of them are within the weight of our own postal limits, so were no more trouble to a Babylonian postman—for there were such centuries upon centuries before the Christian era. Some of the tablets were even enclosed in envelopes; remains of them, bearing addresses, having been found. As Professor Sayce says of some among them:—"That we should possess the autograph letters of a contemporary of Abraham is one of the romances of historical science, for it must be remembered that the letters are not copies, but the original documents themselves." Stripped of their complimentary introductions, for the Babylonians were a polite people, many of these epistles would be nowise out of place in our own correspondence. One writes in early times:—"To my father, thus says Zimri-eram: May the Sun-god and Merodach grant thee everlasting life! May your health be good! I write to ask you how you are; send me back news of your health. I am at present at Dur-Sin, on the canal of Bit-Sikir. In the place where I am living there is nothing to be had for food. So I am sealing up and sending you three-quarters of a silver shekel. In return for the money, send me some good fish and other provisions for me to eat."

It is from these ancient human records that we get the first glimpses of the earliest beginnings of civilisation historically known to us. For several thousands of years Babylonia was the gathering-place of the nations, and was peopled by men and women of higher mental capacity, as it was only the most enterprising of each race who ventured to travel in those remote periods. These, as is the case with modern nations, formed the most progressive nation of ancien times, owing to their admixture and consequent vigorous offspring. Trade was the first incentive to immigration, and later conquest brought them. The extent of Babylonia was annually increased by Nature as well as by occasional conquest. The shore-line was, and still is, always advancing seawards, and geologists are, from the tablet records, now able to calculate its progress. The primitive seaport of Chaldea was Eridu, flourishing 6,500 years before Christ; its site is now about 130 miles from the present coast-line.

The difficulty of the variety of languages spoken in Babylon led to the adoption of a classic, being the

(1) *The Babylonians and Assyrians*, by the Rev. A. H. Sayce, x + 273 pp. 7½ in. × 5 in. (London: John Nimmo. 1900.) 5*s*. net.

tongue of the oldest-known race inhabiting the region. They were the Sumerian people. Therefore we find that the young folks of Babylon had to learn not only the current language of the period, which must have varied considerably in the several thousand years when it flourished, but also to read ancient records in the Sumerian language and in the intricate cuneiform or wedge-shaped characters then used in writing. That the education imparted was very thorough is evident from the comparative absence of bad spelling on the tablets. It is clear from the examples in existence, that education became very general throughout the people, for we find every class, from the kings to the slaves, carrying on correspondence in such a manner as to take it for granted that it could be read and answered without professional assistance, as is now so common with Asiatic people of the lower orders. For those who desired further instruction there were universities; for, though the Babylonians were eminently a commercial people, education seems to have been held in the highest estimation.

The records of primeval Babylonia indicate the conquest of the Sumerians by the Semites; but it was from the former race that the latter learned to live in cities. It appears evident that the Semitic race adopted much of the higher civilisation of the Sumerian people, for we find their influence on the Babylonians to the end of the records. The first rulers of the nation were the high-priests of a mythological religion. These in time became priest-kings, and then the Church was severed from the State, for they come to be described as kings only. For how many untold centuries this condition existed is unknown; but some three thousand years after the time mentioned above, in connection with the city of Eridu, or about 3800 B.C., a definite Semitic Empire was founded by Sargon, after which history becomes more intelligible and nearly consecutive. During those early three thousand years the fusion of the Sumerian and Semitic races seems to have become complete. Under Sargon the empire extended to the Mediterranean Sea, and practically ruled the world so far as then known.

In a short article like this it is not possible to trace the admixture of other racial influences which went to make up Babylon in its ultimate splendour and power. We may refer our readers to the book under notice for much further information. We will, however, return to our tablets and consider some of the points referred to on them, with regard to sociology and science. These tablets have been found in immense numbers in various parts of what was ancient Babylonia. They were evidently treasured and cared for with all the pains taken in a modern library. The tablets were catalogued, so that the librarians could at once find any document required. The collections of tablets were apparently under State control, for they acted also as registries of deeds. The catalogue was founded on the first line of the "book," which consisted of one or many tablets. They were arranged on shelves, and some short time ago one of these libraries, containing about 32,000 tablets, was unearthed at Tello in Southern Chaldea, where every tablet or book was still in order, just as arranged in the age of Gudea 2700 B.C. Literature of every kind was represented, history and chronology, geography, law, private and public correspondence, despatches from generals and proclamations of the king, philology and mathematics; natural science in the shape of lists of beasts and birds, insects and stones, astronomy and astrology, theology and the pseudo-science of omens. There were copies of deeds and contracts, of legal decisions, inventories of properties, and much that has not yet been translated. Every large city had its library, both in Babylonia and Assyria; so there is yet doubtless much remaining undiscovered. Edited copies of the great national epics were kept in the provinces for reference by the people, and there is evidence that they were in request. One point is remarkable, and that is the exact care taken in re-editing or in copying not to mutilate the original, a virtue that has not descended to our own age. Even in time of war the libraries were respected, and during the see-saw of conquest they were removed by the conquerors. Would this had been so during the Christian era!

Even the earliest tablets indicate considerable advance in a social system founded on individual rights, rather than on the strength of might. The position of the women in regard to equality with men during the many centuries of Babylonian prosperity was perhaps stronger than at any other time in the world's history. Both married and single women could trade, independently or in partnership with men, the former with either their own husbands or with other men. They were educated equally with men, might possess independent property, and were fully protected by marriage settlements, numbers of which are extant. These settlements, which appear to have been in the usual course, provided for the wife's position in case of the husband's death or of divorce. Though professedly polygamists, such a condition was rare, as the settlement provided that a second marriage constituted divorce of the first, with a sufficient provision for the first wife.

Marriage seems to have been entirely a civil contract with cash penalties, and, when broken, forfeiture of portion of the goods and furniture. The law courts were admirably organised, with six judges in attendance for each case. The lawyers, like the medical practitioners, with the librarians, also the priests and the Government officials, belonged to the professional classes. There were bankers with fixed rates of interest for regular customers; men of large means who financed, when necessary, a war for the king, or found the money to dig a canal or for other public works. Contracts for these and many other private and public loans are minutely set forth on the tablets, fully witnessed and dated, with the seals of the parties interested duly impressed. Private usury also existed, with interest ranging from 10 to

33 per cent. Money in the earliest days took the form of exchange in kind, but soon resolved itself into metal currency in silver and gold. Copper (and later bronze) appears to have had existence, but little mention has been made of it on the tablets. The shekel "stamped" in silver is most frequently referred to, its approximate value being three shillings. Slavery was universal, the value of a healthy slave being about 30 shekels or £4 10s.; but slaves could rise to high estate, purchase their freedom, and have it presented. Copper was the common metal, bronze was used later, the tin coming from North Cornwall and Southern India. Iron was not used for a long period, and the time of its introduction is doubtful, possibly about the sixteenth century B.C. The characters by which it was first indicated mean "heaven" and "metal," suggesting that it was found on the great plain and the inhabitants knew its meteoric origin.

The exact sciences, as we know them, do not appear to have been understood, though some of the knowledge of the Babylonians pointed in the right direction. Astronomy was perhaps the most advanced, as the larger stars were mapped; there were several royal observatories, and the periods of some lunar eclipses were correctly foretold. There are tablets referring to one at least, in which the astronomer-in-chief tells the king how, following his instructions, he had placed observers over a wide range of Western Asia, and goes on to describe the path of totality. Science was fettered and obscured by the remains of fetish worship, demonology and the occult generally. The thousands of years of civilisation had not wiped out, any more than it has in these days, palmistry and the occult, which are the vogue among some so-called leaders of intelligent society. There is yet, after four thousand years of added civilisation, nearly as much of the original animal left in some of us as there was in those old Babylonian days, when the Mrs. Grundy of the period was quite as exacting as she is now. Some of the tablets referring to law cases show that respectable citizens of that time were not above little indiscretions when her back was turned. It is said to be so even still.

The importance of the science of sociology, as applied to the investigation of man's origin and civilisation, is so evident that it is unnecessary to enlarge on the value of the Babylonian tablets as historical records.

We strongly recommend our readers to obtain this delightful book. There are two or three small faults, but they are simply those of production and not of the author. The first is the irritating phonetic spelling of such words as labour and colour, which if pronounced as printed would be wrong. A more full glossary is required, with a table of approximate dates of the reigns of the Babylonian kings (these would greatly help the uninitiated reader); and, lastly, in the next edition, an enlarged index is sadly needed, the present one being very incomplete. J. T. C.

BRITISH FRESHWATER MITES.

By Charles D. Soar, F.R.M.S.

(*Continued from page* 261.)

GENUS *PIONACERCUS* PIERSIG, 1894.

THE next genus to record is *Pionacercus*. This genus has all the characteristics of *Acercus* except in the genital area. Instead of a number of discs on each side of the genital fissure as in *Acercus* we here find only three, the same as occur in the species of genus *Piona*. This difference will account for the name given by Piersig to this genus. Previous to 1894, species we now find placed in this genus were placed in *Acercus* or *Piona*. There are not many species known. Piersig only describes two in his work on the Hydrachna of Germany. I shall be able to record at least three for Britain, and I have a fourth which I found in the Upper Lake, Cwm-Glas in North Wales, that I have not yet been able to name, which may be a new species of *Pionacercus*.

1. *Pionacercus leuckarti* Piersig, 1892.

Male.—Body oval in form, rather broader towards the posterior. Length about 0.48 mm.; breadth about 0.37 mm. Colour a yellowish-brown

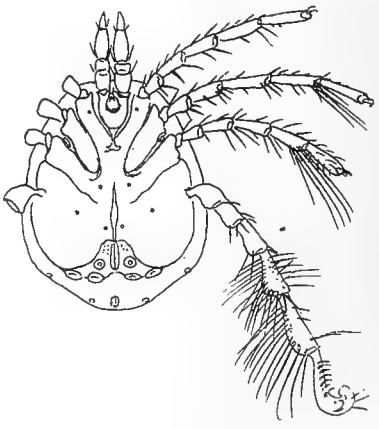


Fig. 1. *P. leuckarti.* Dorsal surface, male.

with brown markings, and a yellow patch in centre of dorsal surface. Eyes large and prominent.

Legs.—First pair about 0.48 mm.; fourth pair about 0.55 mm. Colour a very pale blue. The first and second pair are very much alike, and are very similar to those we find on *Curvipes* and others. The third pair are rather modified, the tarsi being thick, short, and very hairy, with the claws very small (fig. 2). The fourth pair, as we found in *Acercus*, are very different to the others in having the tarsi curved, and on the inner curve are a number of teeth, like a comb. In the specimens I have examined (fig. 3) there are seven of these teeth in a row.

Epimera.—Arranged in one group.

Palpi.—About 0.20 mm. long, rather short and thick. There is a small peg at the last joint slightly overlapping the fifth segment and placed on the inner edge.

Fig. 2. *P. leuckarti.* Tarsus of third foot.

Genital Area.—Has three discs on each side of the genital cleft (fig. 1).

Female.—Rather larger than male. The Epimera are arranged in four groups. Legs without the modifications we find in the male.

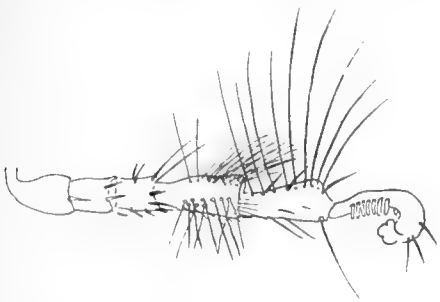


Fig. 3. *P. leuckarti.* Fourth leg.

Localities.—Found by Dr. George in Lincolnshire, and by Mr. Scourfield in the Lake District.

2. *Pionacercus uncinatus* Koenike, 1885.

I have only seen one male of this species. It was sent to me by Mr. Scourfield in 1895. He found it at Llyn-y-Gades, Cader Idris, North Wales. It was in rather bad condition, so much so that I was only able to make a few notes and take an outline drawing of the fourth leg and palpi. In the curve of the tarsi there are only four teeth, instead of seven, and the palpi are without the small peg I mentioned in *P. leuckarti* on the last joint. In colour it was a deep orange-yellow. I hope some other collector will again find this species.

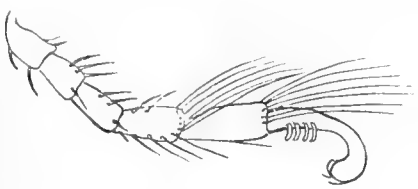


Fig. 4. *P. uncinatus.* Fourth leg.

3. *Pionacercus vatrax* Koch, 1835.

Male.—Oval in form. Length about 0.44 mm.; breadth about 0.36 mm. Pale yellow in colour, with brown markings.

Legs.—First pair about 0.56 mm.; fourth pair 0.48 mm. Tarsi of the first two pairs rather large and prominent; tarsi of third pair modified similar to fig. 2. Fourth pair of legs show a very great difference to the others noticed (figs. 3 and 4), in having a long spur projected from the fourth segment (fig. 5 at *a*). This spur is very plainly shown in Koch's figure.

Fig. 5. *P. vatrax.* Fourth leg.

Epimera.—Not quite formed in one group, as fig. 1, each pair being lined out distinctly, although close together. Otherwise the general form is about the same.

Palpi.—Long and thin, fig. 6 being about 0.40 mm., nearly the length of the body. Koch's little figure also shows the long palpi. They have the small peg mentioned in *P. leuckarti*, near the fifth segment (fig. 6 at *a*).

Fig. 6. *P. vatrax.* Palpus.

Genital Area.—Very similar to that shown on fig. 1.

Localities.—Found on the Norfolk Broads, April 1899.

Piersig, in his work on German Hydrachna, plate XXVII., fig. 70, has figured in outline this mite of Koch's; but I cannot find it mentioned in the letterpress. On the fly-leaf of the plate it is named *Acercus vatrax*. Koch named his mite *Tiphys vatrax*; but if my mite and Koch's are the same—and I have every reason to believe they are by the spur on the hind leg and the length of palpi—its proper genus must be *Pionacercus*.

(*To be continued.*)

London University Election.—In the last number of Science-Gossip we referred (p. 281) to the need of a third candidate for the parliamentary representation of the London University, caused by the elevation of Sir John Lubbock to the Peerage. Such candidate came in the person of Sir Michael Foster, K.C.B., F.R.S., D.C.L., D.Sc., &c. It is most satisfactory to find that the electors returned Sir Michael, the numbers on declaration of the poll being: Sir M. Foster, 1,271; Dr. Collins, 863; Mr. Busk, 586. The high reputation of the new member as a physiologist, and man of science generally, reflects the greatest credit on the choice of those electors who supported their new member.

RADIOGRAPHY.

By James Quick.

(*Continued from page 270.*)

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Fig. 25. Forearm, showing Double Fracture of Ulna and Radius.

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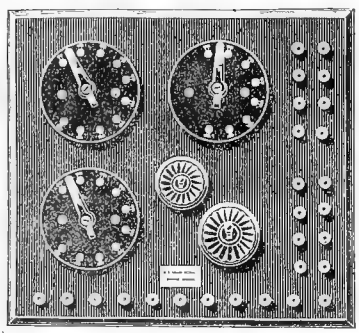

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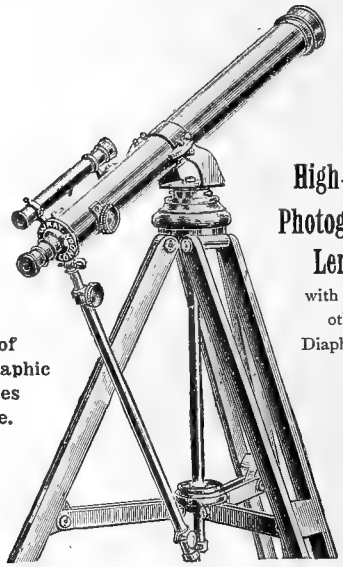

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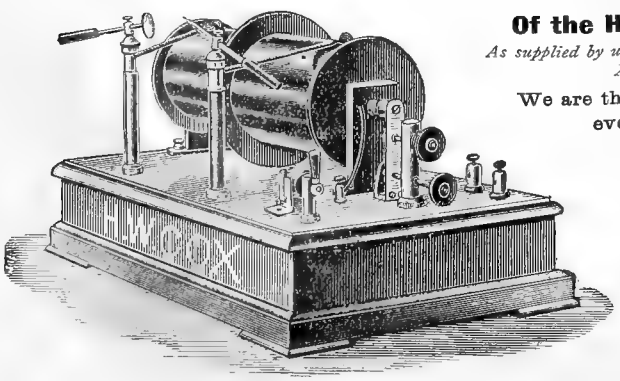

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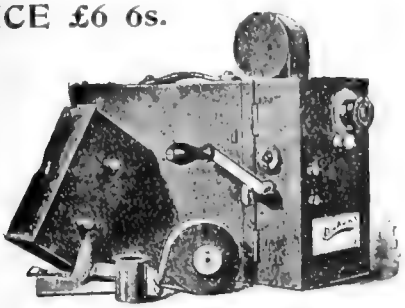

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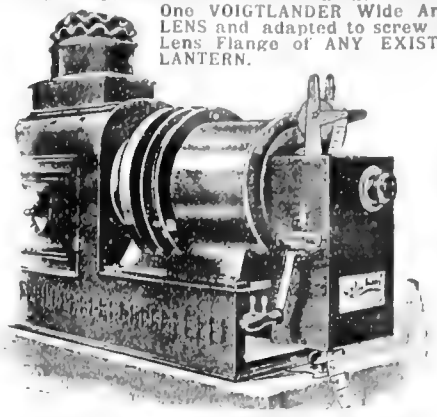

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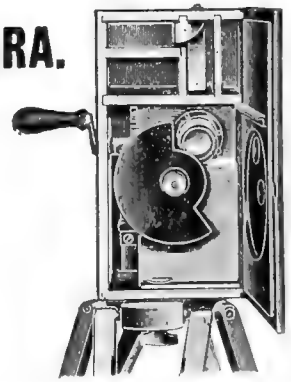

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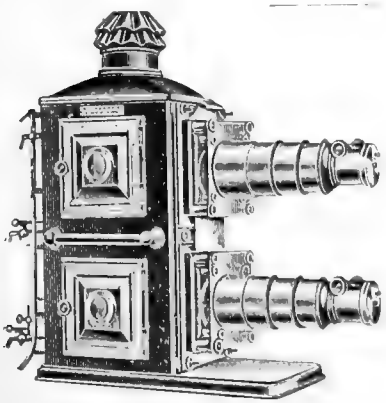

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the Chitral campaign, and by Major Battersby, R.A.M.C., in the Nile expedition of the Soudan campaign. The results in both these cases proved beyond doubt that very valuable aid was given to the medical officers.

Ten complete sets of apparatus have been officially sent to the seat of war in South Africa, and in addition to these many have been taken by officers.

The successful work of Major Battersby in the Soudan was summarised by that officer in an excellent paper read by him before the Röntgen Society of London, in January 1899. The high temperatures of the country traversed [illegible] one of the greatest difficulties with which he had to contend, particularly on account of the danger to which the induction coil was exposed of having its insulation broken down by the softening of the wax in the

Fig. 26. Leg, fractured just above the Ankle.

The coil and other items were therefore wrapt in wet flannels to keep the temperature low by evaporation. To render the coil more portable it was made in two parts, in a manner similar to most of the big coils in use at present. The coil part was

packed in one box, and the condenser and other parts in another.

Major Battersby's arrangement for the generation of electricity was indeed an ingenious one. He says: "The pulley of a small dynamo was connected by means of a leather strap with the back wheel of a specially constructed tandem bicycle. The required velocity for the dynamo was thus obtained, and our procedure was as follows: Having carefully adjusted the circuit with the storage battery, and also with the voltmeter and ammeter, my warrant officer took his position on the seat of the bicycle and commenced pedalling. When 15 volts and 4 ampères were registered, the switch close to the handle of the bicycle was opened, and charging of the battery commenced. As the resistance became greater, a sensation of riding uphill was experienced, and the services of an additional orderly were requisitioned for the front seat. This bicycle practice was generally carried out in a shade temperature of 110° Fahr., so that at the end of half an hour we unanimously agreed that some other form of scientific amusement was desirable. The switch now having been turned off before pedalling ceased, in order to avoid any discharge from the battery, the machine was brought to a standstill." Major Battersby invariably used glass sensitised plates. The temperature of the water employed in development being high, and ice being unobtainable, fine details upon the negatives had to be sacrificed. As a rule development was done at three o'clock in the morning, that being the coolest part of the day.

After the battle of Omdurman 121 wounded British officers, non-commissioned officers, and men were brought to Abadieh. Of that number there were twenty-one cases that could not be diagnosed accurately by ordinary surgical means, and of these the presence or absence of a bullet was in twenty instances proved by the X-rays. The odd case was that of a shot in the lung, so severe that at the time it was not considered justifiable to examine.

In many instances X-ray observations have materially assisted the dentist. Teeth are more opaque to the rays than bone, hence a radiograph shows clearly the teeth distinct from their surroundings. Small celluloid sensitive films, about 1 inch by ½ inch, are used, wrapped in black paper and then enclosed in thin sheet rubber. They are placed inside the mouth, and held close to the teeth by the tongue. Exposure and development of the films are made in the usual manner. Dr. Knolle's instrument, the dentiaskiascope, for examining the teeth, consists of a small fluorescent screen in an aluminium case, so placed that the screen-image is reflected upon a mirror, which the operator views through a tube.

We are indebted to Mr. A. C. Cossor, of 67 Farringdon Road, London, for use of original prints and permission to reproduce them, for figs. 25 and 26 in this number. The safety-pin shown in fig. 25 was used to secure a bandage.

(*To be concluded next month.*)

A HISTORY OF CHALK.

By Edward A. Martin, F.G.S.

(*Continued from page 235.*)

With the progress of geological science, less prominent beds in a system receive more detailed examination, with the result that greater importance attaches to certain minor beds than was formerly the case. At one time, in the case of the Cretaceous now before us, it was sufficient to classify the subordinate divisions thus:—(1) Chalk with Flints; (2) Chalk without Flints; (3) Chalk Marl; (4) Upper Greensand; (5) Gault.

A more explanatory and detailed table is now necessary, and we have to consider each of the formations given below:—

Danian.	Faxoe Limestone.
	Pisolitic Limestone.
	Maestricht Beds.
Senonian.	Zone of *Belemnitella mucronata.*
(Upper Chalk)	,, ,, *Marsupites.*
	,, ,, *Micraster cor-anguinum* and *M. cor-testudinarium.*
Turonian.	,, ,, *Holaster planus* (Chalk Rock)
(Middle Chalk)	,, ,, *Terebratulina gracilis.*
	,, ,, *Rhynconella cuvieri.*
	,, ,, *Inoceramus labiatus* (Melbourne Rock).
Cenomanian.	,, ,, *Belemnitella plena.*
(Lower Chalk)	,, ,, *Ammonites rhotomagensis*
	,, ,, *Holaster sub-globosus* (Grey Chalk), with Totternhoe Stone at base.
	,, ,, *Ammonites varians.*
	,, ,, *Plocoscyphia meandrina* (Chalk Marl).
Albian.	,, ,, Chloritic Marl.
(Upper Greensand)	,, ,, *Pecten asper.*
	,, ,, *Ammonites inflatus.*
Albian.	(including a contemporaneous portion
(Gault)	of the Hunstanton Limestone, or "Red Chalk," and the Blackdown Greensand in Dorset and Devon).

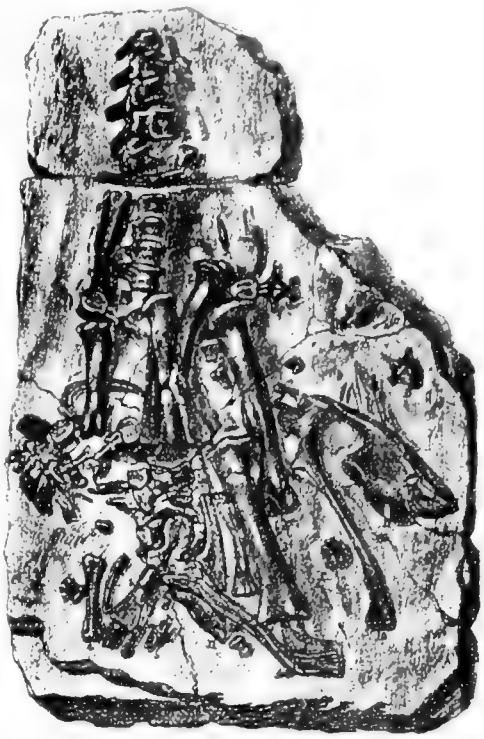
The division of the beds into those which contain flints and those which do not has now completely broken down; since, as we shall see, there are beds in the Upper Chalk which contain no flints at all, whilst on the other hand there are beds of the Lower Chalk, as in Yorkshire, where tabular flints are a prominent feature. It is customary now, wherever possible, to divide strata into zones, these being named after some fossil, either peculiar to the zone or, at any rate, very prominently associated with it. This system of nomenclature is especially valuable in the case of the Chalk, since names based on purely lithological distinctions are quite valueless when an attempt at correlation is made with beds of similar age in other lands where there is no resemblance to chalk at all. This system, first introduced by

Professor Hébert in 1862, has been considerably extended by Dr. C. Barrois, and is being very widely adopted.

The Wealden was at one time regarded as part of the Jurassic or Oolitic system. It has since been separated from this association, and placed below the base of the Cretaceous. In a similar manner the Purbecks, at the top of the Jurassic, are more correctly regarded, together with the Wealden, as passage formations, containing as they do fossil representatives both of Jurassic and Cretaceous times. In Southern France, and on the south slopes of the Alps, there are rocks known as Tithonian, which are regarded by French geologists as Cretaceous. Possibly they are of pre-Wealden age or even contemporary with that formation. The Tithonian includes the well-known Diphya Limestone with its distinguishing fossil *Diphya terebratula*.

Interesting as would be a consideration of the wonderful fossil remains discovered in the Purbecks and Wealden Beds, we must not linger over them, since we have now relegated them to a new system—the Neocomian—and cut them off from the Cretaceous. Suffice it to say in regard to the Purbecks that in a layer a few inches in thickness have been discovered the jaws of no less than twenty-five species of a low type of marsupial mammals. In older formations than this, only four have been found in the Stonesfield (Oolite) Beds, and four in beds of Upper Trias age. In the Chalk beds not any remains of mammals have been found, so we have here the remarkable fact that between strata which must themselves have taken inconceivable ages to form, and which are utterly barren of mammal remains, there is isolated this thin Purbeck seam containing so large an assemblage of them. There they are, and there is the proof that they existed; but there must have been many more. The very fact of their existence impels us to believe this. Yet thousands of feet of sand and chalk are absolutely silent as to mammal life, and not until the Chalk age is past and gone do we find the order of mammals again exhibiting its remains in the rocks. *Triconodon*, *Plagiaulax*, and *Spalacotherium* are the generic names of three Purbeck mammals. What became of their descendants in the Wealden age?

How did these small creatures fare when they had to struggle for existence amidst the forests tenanted by giant lizard-like monsters, and when extinction may fairly have been expected to wait upon them? For answer the geological record is silent. It is possible that the evolution of the *Marsupialia*, which has been so successfully carried through in Australia, took a yet earlier start in the British area, and, like a race "born out of due time," they actually did become extinct when in the Wealden age giant reptiles held the sceptre of power, when the great *Iguanodon*, *Megalosaurus*, *Regnosaurus*, and many another, lorded it over other creatures inferior in size and strength, which went to make the fauna of portions of England, Belgium, and France in these pre-Cretaceous times. Be that as it may, the Cretaceous era was to pass away before mammals again showed themselves, and then not until the Paris gypsum came to be laid down in Eocene time were their remains again entombed.



Iguanodon (after Mantell)—Kentish Rag, Maidstone.

2, Femur; 3, tibia; 7, radius; 8, various vertebrae; 10, clavicle.

The Gault clay, forming the base of the system with which we are particularly concerned, is a formation that is found, in connection with what has been called the Upper Greensand, to occur with remarkable consistency immediately beneath the chalk in the South-East of England. Wherever in the south of Cambridgeshire the chalk terminates at the surface there is always to be found, cropping from beneath it, either the Upper Greensand or the Gault. Except in North Kent, the Gault outcrops all around the Weald with the greatest regularity, and stretches from its most westerly termination near Selborne, in Hampshire, to the Kentish coast; at Folkestone in the case of its northern branch, and to the Sussex coast, near Eastbourne, in the case of its southern branch.

(*To be continued.*)

The Yerkes Observatory is evidently doing good work, according to its first annual report. Good measurements of difficult objects have been effected. The heat received from the star Arcturus is about equal to that from a candle six miles distant.—*F. C. Dennett.*

AN INTRODUCTION TO BRITISH SPIDERS.

By Frank Percy Smith.

(*Continued from page* 240.[1])

GENUS *ULOBORUS* LATR.

THIS genus may be readily distinguished by the position of the eyes, as shown on fig. III., Uloboridae. It will be noticed that the convexity of each row of eyes is directed forwards. The genus contains but one British species.

Uloborus walckenaerius Latr. (*Veleda lineata* Bl.).

Length of male 3.7 mm., length of female 5.3 mm.

The cephalo-thorax is covered with pale hairs, and has several longitudinal stripes of dark and light brown. The legs are yellowish-brown with annulations of a darker hue. The upper side of the abdomen is of a pale, dull, yellow tint, with longitudinal, dark-brown lines.

This rare spider has been found in Dorset and Hampshire.

GENUS *HYPTIOTES* WALCK.

This genus differs from *Uloborus* in the position of the eyes, the convexities of the two rows being directed towards one another.

Hyptiotes paradoxus C. Koch.

Length of male 4.2 mm., length of female 5.3 mm.

Cephalo-thorax light brown, covered with hairs. Legs similar in colour, covered with hairs and spines. Abdomen of a brown colour mottled with darker and paler tints. The digital joint of the male palpus is of enormous size, as also are the palpal organs.

This extremely rare spider has been found in Cumberland.

FAMILY DICTYNIDES.

We now come to a family of spiders which includes several species that are common and well known. The species present considerable variation in size, but may be distinguished by the following characters:—Caput rather broad, the eyes being placed in two transverse rows. The females have calamistra, a supernumerary spinner being present in both sexes. The falces are rather strong, but not greatly divergent.

GENUS *DICTYNA* SUND.

In this genus the cephalo-thorax is considerably raised just behind the ocular area. The maxillae are straight and inclined towards the labium, which is large. The abdomen projects over the cephalo-thorax. Legs 1, 2, 4, 3.

Dictyna arundinacea Linn. (*Ergatis benigna* Bl.)

Length. Male 3.1 mm., female 3.5 mm.

The cephalo-thorax is dark brown, the caput being clothed with lines of pale hairs. The legs are brown. The abdomen is yellowish-brown, clothed with pale hairs, and has a deep brown band along its upper surface, which is interrupted towards the spinners so as to form a series of transverse bars. The radial joint of the male palpus has a small process, bifid at its extremity, projecting from near the base on the upper side. Attached to the palpal organs is a long curiously twisted spine, directed backwards.

This spider is rather common, spinning its snare in the blossoms of heather and rushes.

Dictyna uncinata Thor. (*Ergatis arborea* Cambr.)

Length. Male 2.5 mm., female 2.7 mm.

This species is similar in form and markings to *D. arundinacea* Linn., but may be distinguished without difficulty if the process on the radial joint of the male palpus be examined. In the present species it is long, and springs quite from the base of the joint instead of near it. The radial joint is longer than the cubital. This is not uncommon in the Southern counties of England.

Dictyna pusilla Westr.

Length. Male about 2.8 mm.

This spider is similar to the last, but may be distinguished from it by the radial joint of the male palpus being shorter than the cubital. It is rare. Localities. Oxford, Guildford.

Dictyna latens Fabr. (*Ergatis latens* Bl.)

Length. Male 2.8 mm., female 3 mm.

This species is very similar in structure to *D. arundinacea* Linn. It may be distinguished by its smaller size and by its dark grey colour.

Dictyna lugubris Cambr.

Length. Male 3 mm.

This extremely rare spider is similar in general form to *D. arundinacea* Linn., but may be distinguished by its very dark brown colouration.

Dictyna viridissima Walck.

Length. Male 4 mm.

This species is also similar to *D. arundinacea* Linn., but is much larger and of a distinctly green hue.

Dictyna variabilis C. Koch.

This spider is very rare, but is easily distinguished by the colour of the abdomen, which is a bright pinkish yellow.

(1) This series of articles on British Spiders commenced in Science-Gossip, No. 67, December 1869.

GENUS *LETHIA* MENGE.

The genus *Lethia* contains a number of small spiders distinguishable from *Dictyna* by the form of the cephalo-thorax, which is less convex than in that group. Legs 1, 2, 4, 3, or 1, 4, 2, 3, the fourth and second pairs being always nearly equal.

Lethia humilis Bl.

Length. Male, 2 mm.; female, 2.5 mm.

Cephalo-thorax brown, with a darker margin. Legs pale brown, with annulations of a darker tint.

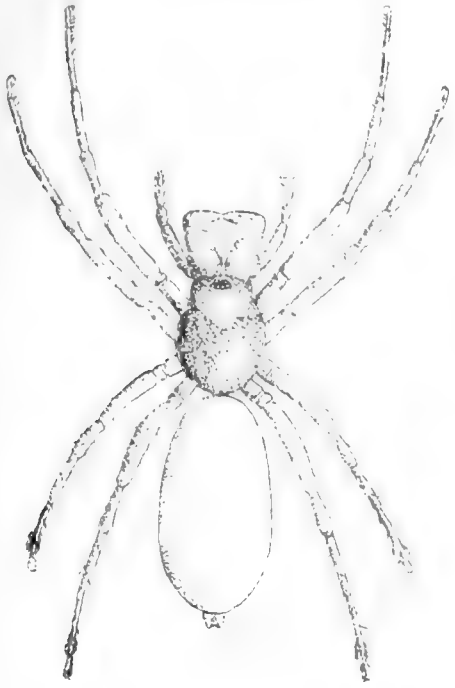


Fig. V. *Dysdera crocota.*

The abdomen is prettily marked with a distinct pattern. The cubital joint of the male palpus has a short projection on its upper side. The palpal organs are rather simple. This spider is not at all uncommon in the South of England.

Lethia mengii Cambr.

Length. Male, about 2 mm.

This extremely rare spider may be distinguished from the last by the absence of the projection on the cubital joint of the male palpus, and by the complexity of the palpal organs. It has only been found in Dorset.

Lethia puta Cambr.

Length. Female 1.7 mm.

This is similar in structure to *L. humilis* Bl., but is much smaller, and the abdominal pattern is very indistinct. It is extremely rare, and is recorded from Dorset.

Lethia albispiraculis Cambr.

Length. Female 2 mm.

Very similar to the last species, but may be distinguished by the colour of its spiracular plates, which are brilliant white. It has been found in Dorset.

Lethia subniger Cambr.

Length. Male 2.1 mm.

Cephalo-thorax dark brown. Legs yellowish brown. Abdomen almost black with a few pale hairs. This spider is very rare. It has been taken at Winchester.

Lethia patula Sim.

Length. Female 4.2 mm.

This rare spider is similar in appearance to *L. puta* Cambr., but is much larger.

Lethia spinigera Cambr.

Length. Male 1.8 mm.

This spider may be distinguished from the rest of the genus by its possessing a spine on the tibiae of the third pair of legs.

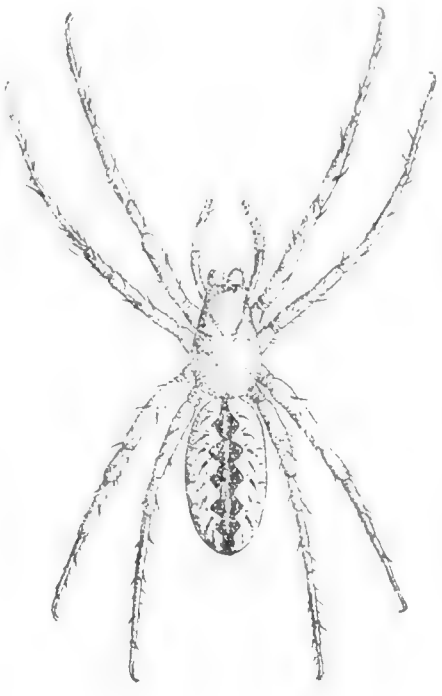


Fig. VI. *Segestria senoculata.*

GENUS *AMAUROBIUS* C. KOCH.

The spiders of this small but important genus are very similar, both in appearance and habits, to those of the family Agelenidae, with which they were formerly classed. The possession of calamistra and supernumerary spinners, however, necessitates their removal from that group. The caput is very slightly raised, and the eyes are arranged in two transverse rows as shown in fig. IV. The three British species representing this genus are all rather large, two of them being very common.

Amaurobius fenestralis Stroem. (*Ciniflo atrox* Bl.)

Length. Male 7.3 mm., female 8.4 mm. The size of this spider is subject to much variation.

Cephalo-thorax yellowish-brown, the caput being much darker. Legs pale brown, indistinctly annulated with a darker hue. The abdomen has at its anterior part a dark blackish-brown marking. This spider may be found during the winter months under the loose bark of decaying trees in dry situations. It is very common, and generally distributed throughout the country.

Amaurobius similis Bl. (*Ciniflo similis* Bl.) See fig. IV.

Length. Male 10.5 mm., female 12.6 mm.

This species is similar in general appearance to the last, but may be distinguished by the following differences:—The abdomen is of a colder grey tint, the dark marking on its fore part being less distinct and more broken up. The radial joint of the male palpus has a black curved apophysis (shown in fig. IV.); the corresponding projection in *A. fenestralis* Stroem. is paler, and neither so much curved nor so narrow. This spider is even more common than the last, and may be found behind boards in outhouses, under floors, or in openings in brick walls, around which latter it spins a mass of flocculent web of a bluish tint. I have noticed that the percentage of males in this species is far less than in the case of *A. fenestralis* Stroem.

Amaurobius ferox Walck. (*Ciniflo ferox* Bl.)

Length. Male 10 mm., female 13 mm.

This species, which is found in similar situations to *A. similis* Bl., may be distinguished by its dark sooty colour, and also by the form of the palpal organs. In this species the pale lobe, which is present in the other species of *Amaurobius*, is greatly developed and of a brilliant white colour. The female is a very powerful spider, and is one of our largest species.

Family DYSDERIDAE.

This family may be distinguished from all others (except Scytodidae) by the species it contains possessing but six eyes. The spiracular openings are four in number.

GENUS *DYSDERA* LATR.

This genus may be distinguished by the position of the eyes, which are arranged in the form of a horseshoe, with its open side in front. The tarsal claws are two in number. Two British species only are at present known.

Dysdera cambridgii Thor. (*Dysdera erythrina* Bl.)

Length. Male 12 mm., female 12.5 mm.

Cephalo-thorax bright reddish-brown, legs reddish-yellow, abdomen pale yellowish-grey, falces of the same colour as the cephalo-thorax and extremely prominent. This is a very striking and distinct spider, and is found, though not commonly, under stones and decayed bark.

Dysdera crocota C. Koch. Fig. V.

Length. Male 12.2 mm., female 12.8 mm.

This spider is exceedingly like the last in structure and habits, but may be distinguished by the form of the male palpal organs, which, in this species, end in two distinct prominences. It is rather uncommon. The female is represented on fig. V.

GENUS *HARPACTES* TEMPL.

This genus may be distinguished from *Dysdera* by the position of the eyes, which form almost a circle. The tarsal claws are three in number. Only one species has been found in Britain.

Harpactes hombergii.

Length. Male, 6 mm., female 6.3 mm.

Cephalo-thorax. Dark red-brown. Legs. Pale yellowish-brown, indistinctly annulated with a darker hue. Abdomen. Brownish grey. This spider is not uncommon under loose bark and stones in dry situations.

GENUS *SEGESTRIA* LATR.

This genus may be at once distinguished from the preceding genera by the position of the eyes, which are arranged in three groups of two each, the groups being placed in a transverse line. The tarsal claws are three in number.

Segestria senoculata Linn. Fig. VI.

Length. Male 6.3 mm., female 10.5 mm.

Cephalo-thorax. Dark brownish-grey. Abdomen. Yellowish-grey with a series of diamond-shaped blackish patches along the centre of its upper surface. The palpal organs are very simple, consisting of a bulb gradually drawn out into a fine point. This is not an uncommon spider under loose bark. The female is represented on fig. VI.

Segestria bavarica C. Koch.

Length. Male 7 mm., female 11 mm.

This spider is very similar to *S. senoculata* Linn., but may be distinguished by being more hairy, and by the bulb of the male palpal organs being drawn out more abruptly. It is very rare.

Segestria florentina Rossi.

Length. Male 18 mm.

This extremely rare spider may be at once distinguished by the brilliant green colour of the falces.

GENUS *SCHOENOBATES* BL.

The position of this genus is very doubtful, as it appears to bear a close relationship to the Theridiidae, but differs in the possession of six eyes only.

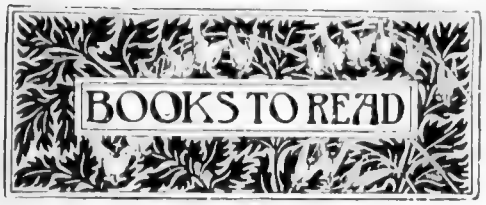
Schœnobates walkeri Bl.

Length. Male, 3·1 mm.

Cephalo-thorax red-brown, with white hairs. Abdomen mottled brown, also clothed with white hairs. It is extremely rare.

[Note.—In consequence of a printer's error, *ante* page 239, line 14, second column, read "many," instead of "any."—Ed. S. G.]

(*To be continued.*)



NOTICES BY JOHN T. CARRINGTON.

A Book of Whales. By F. E. BEDDARD, M.A., F.R.S. xv + 320 pp., 8⅛ in. × 6 in., with 40 illustrations. (London: John Murray, 1900.) 6s.

This is the seventh volume issued of the admirable Progressive Science Series, edited by the author of the work before us. In dealing with this somewhat difficult subject, the author reminds us how little is really known about the life-histories of the true whales and even less about their allies the Delphinidae. We imagine that though the popular interest in whales will always be active on account of their size and the scarcity of opportunity for examination, an accurate knowledge of their economy will be long in arriving. This difficulty of personally observing the Cetaceans is probably the reason for the sparse attention they have received from men of science. Indeed, the work before us is the only popular treatise provided by a modern scientific writer that covers the full range of whales, rorquals, beaked whales, and dolphins, recent and fossil, of the earth. Mr. Beddard's chief object in writing this volume for the Progressive Science Series has not only been to say what is known of Cetaceans, but also by means of the group of whales to illustrate a very important generalisation—the intimate relation between structure of animals and environment. No group exhibits this in a more remarkable degree. The author has made this volume pleasant to read by the layman as well as the science student, as he has included much ancient lore about the great marine beasts and many anecdotes about hunting of whales. The drawings are by Mr. Sidney Berrage, and are generally effective. As a whole Mr. Beddard's book is a valuable contribution to the literature of whales and their allies, and a useful addition to any general library. An important point in its favour is that Mr. Beddard has verified, as far as possible, all his statements; some being new facts.

History of Strood, by Henry Smetham, xii + 431 pp., 9 in. × 6 in., with 94 illustrations. (Strood: Sweet & Sons. 1899.) 7s. 6d.

This is a carefully written history of Strood, a thriving town on the banks of the river Medway, opposite the city of Rochester, with which it is equally ancient; having been of importance since the early Roman occupation of Britain. From the point of view of natural science there are in this book two appendices of local value. The first is a geological sketch of the district by Mr. G. E. Dibley, F.G.S. It is popularly written, rather to interest the uninitiated than as a scientific memoir. It is consequently more useful in connection with a local history. This geological appendix occupies sixteen pages. Following is an appendix on the flora and fauna of Strood, by Mr. J. W. Tutt, F.E.S., who, by the way, is a native of Strood. Both these are interesting and ought to add recruits to the by no means small band of students of Nature already to be found in Strood, Rochester and Chatham. It is curious to note that in 1673 there was a saffron garden in Strood that let at a rental of £10 per annum, so must have been of considerable size. The lover of archaeology will find in Mr. Smetham's "History of Strood" much of more than local interest, and the general reader will be induced to visit this quaint town and its picturesque surroundings.

The Mycetozoa. By the Right Hon. Sir EDWARD FRY, D.C.L., LL.D., F.R.S., and AGNES FRY. viii + 82 pp., 7 in. × 5 in., with 22 illustrations. (London: "Knowledge" Office, 1899.) 1s.

This is a reprint in book form of a series of useful articles that appeared in our contemporary, "Knowledge," upon these generally little understood lowly forms of life. Affectionately termed "myxies" by the authors, their subjects constitute the borderland between plant and animal life. Messrs. Witherby have done well to issue this little book, as it gives an impetus to the study of some of the most remarkable forms to be found in Nature. It is well worth its published price.

Transactions of the Hull Scientific Society for 1899. Edited by THOMAS SHEPPARD and J. R. BOYLE, F.S.A. 70 pp., 8½ in. × 5½ in., with 3 illustrations. (Hull: Brown & Sons. 1899.) 1s. 6d.

The editors of this part, and the members generally of the Hull Scientific and Field Naturalists' Club, are to be congratulated upon its production. Though very wisely confined to strictly local matters, it contains much of general interest. There are several good papers on subjects relating to archaeology, botany, zoology, and geology.

The Birds of Eastern North America. Part II Land Birds. By CHAS. B. CORY, F.L.S., F.Z.S. ix + 132 to 387 pp., 9⅓ in. × 7 in., with many illustrations. Special Edition. (Chicago: Field Columbian Museum. 1899).

The author of this work is Curator of the Department of Ornithology in the Field Museum at Chicago, and Vice-President of the American Ornithologists' Union; also member of the British Ornithologists' Union. This part is a key to Families and Species, and is elaborately illustrated. It is prefaced by instructions for measuring birds, according to the system used in its pages.

Croydon, New and Old. By EDWARD A. MARTIN, F.G.S. 134 pp., 7¼ in × 5 in., with maps and illustrations. (London: Beechings, Limited.) 6d.

Mr. Martin has produced, not only a chatty account of Croydon and its district, but also a useful book of reference. At the end of the work are numerous suggestions for excursions and country rambles which will be found worth exploring by residents in Croydon. Most of them are within easy reach of London. As he proceeds, the author gives pleasant particulars of the geology, also of the plants and animals by the way.

The Evolution of Geography. By JOHN KEANE. xv + 150 pp., 8½ in. × 5½ in., with 26 coloured and plain illustrations. (London: Edward Stanford. 1899.) 6s.

The second title of this work is "A Sketch of the Rise and Progress of Geographical Knowledge from the Earliest Times to the First Circumnavigation of the Globe." The book forms a most interesting introduction to the fascinating study of geography and attendant exploration. Here we can trace the

first groping in the geographical darkness by referring to the early maps reproduced in Mr. Keane's book. It is instructive to find on a map of the date 500 B.C. the general contour of the Mediterranean delineated with such considerable exactness, showing how long had been the time its waters had been used for navigation before that date. Of course this must have been the case, as we know the Phoenicians supplied Babylon with tin from Cornwall a thousand years previously. The author has told his story with much judgment, and pleasantly; and we can recommend the work to our readers.

A Book of the Fields and Woods. Edited by J. P. STEELE. x + 112 pp., 7 in. × 4½ in., with illustrations. (Leek: W. H. Eaton, 1899.) 1s. 3d.

The "First Book of the North Staffordshire Clarion Field Club" is its second title. It is beautifully produced, with many quaint illustrations, and is full of country lore in the form of nicely written essays.

Chemistry for Organised Schools of Science. By S. PARRISH, B.Sc., A.R.C.S.Lond., and D. FORSYTH, M.A., D.Sc. 262 pp., 7 in. × 4⅝ in., with 108 illustrations. (London: Macmillan & Co., Limited, 1899). 2s. 6d.

Although this volume is described on the cover as being the work of Messrs. Parrish & Forsyth, it appears that Dr. Forsyth's part is the writing of the preface only. We are therefore all the more ready to heartily congratulate Mr. Parrish on the production of such an excellent manual. The old-fashioned stereotyped order in elementary text-books of Chemistry is so familiar that the strikingly new arrangement in the present work will be a great relief to all well-wishers of the science. It is indeed a long time since we have seen the elementary facts of this fascinating subject laid down in so clear a manner, or so carefully gauged as to suit the capacity of the young scholar. We do not doubt that the work will tend towards the production of a solid foundation in the mind of the student. Amongst the most satisfactory pages of the book we would mention the "Rules to be Observed in Weighing," the series of excellent questions at the end of each chapter, and the chapter on the determination of equivalents. This last is very clearly written, and in conjunction with that on "Valency" cannot fail to give the student a clear grasp of the essential points of the laws which govern the selection of Atomic Weights. The illustrations, being reproductions of photographs of actual apparatus, will be of more help than the pen-and-ink sketches which are usually found in works of a similar purport. Seeing the many advantages of the work as a whole, we cannot refrain from noting one or two points which will, no doubt, be altered in a second edition. After carefully describing the decimal system, and stating that "the system of measurement employed in Chemistry is that known as the Metric System," the author speaks (p. 42) of "test-tubes 6 in. × ¾ in.," and again (p. 45) of "tubing $\frac{5}{16}$ in. bore" and "gauze held 1½ in. from the mouth." We cannot help thinking that the adoption of the decimal system is seriously delayed by the introduction of such expressions as inches and pounds in the works of the very people who endeavour to point out the advantages of cutting adrift from the unscientific method at present in use in Britain. The contractions "grm." and "ccs." are, we are sorry to note, employed in error for "g." and "ccm." One strictly chemical point calls for alteration. This is the use of the term "hydrate" in mistake for "hydroxide." We have no doubt that this, too, will be noted in the second edition.—H. M. R.

WE are pleased to report that our editor, Mr. Carrington, is making good progress in convalescence. He hopes to be able to resume his active association with the magazine in about a month's time.

WE regret that our limited space prevents the insertion this month of several important articles already in print, and the continuance of Dr. Bryan's articles on "Desmids," "The Baltic Amber Mines," with others.

MR. R. H. PORTER, of 7 Princes Street, Cavendish Square, London, announces a new work on the birds of Surrey, by Mr. John A. Bucknill, M.A. It is to be issued by subscription and will contain map, local and other illustrations.

IT is with sincere regret that we hear, from his son, of the death of our contributor Mr. E. S. Layard, of Budleigh-Salterton. This eminent naturalist, who was so devoted to the study of conchology, died on New Year's Day.

AFTER thirty-three years' service, including the early vicissitudes of the Department, Mr. Robert H. Scott, F.R.S., the chief of the British Meteorological Office, has resigned that position. He will be followed by Mr. William Napier Shaw, F.R.S., Assistant Director of the Cavendish Laboratory, Cambridge.

MR. CHARLES WHITEHEAD, F.L.S., F.Z.S., technical adviser to the Board of Agriculture, has, on account of ill-health, retired from that post. His duties have been chiefly in relation to economic entomology. Communications relating to such subjects are to be directed to the Secretary, Board of Agriculture, London.

PROFESSOR W. W. WATTS forwards us the "Tenth Report of the Committee of the British Association for obtaining Photographs of Geological Interest in the United Kingdom." Mr. Watts is secretary to the Committee. The additions for the year include sixty-one prints and six slides. The collection now numbers 324 prints and 101 slides.

PROFESSOR DAVID EDWARD HUGHES, whose death occurred at the end of January, was born in May 1831, of Welsh ancestry. He was an eminent and successful physicist, who devoted much attention to invention. Among the many interesting instruments created by his fertile brain was the microphone, that wonderfully delicate recorder of sound. He was a Fellow of the Royal Society, which awarded him a medal in 1885.

THERE died on February 6th, aged 77 years, an entomologist well known among lepidopterists some twenty years ago. This was Walter Battershell Gill, M.D. Lond., F.R.C.S. He was the only son of Captain T. Gill, R.N., of Brock Hall, Hereford, and brother of another well-known lepidopterist, Mrs. Hutchinson of Grantsfield, Leominster. Dr. Gill ceased to take an active interest in entomology a few years ago and his collections were sold at Stevens' Auction Rooms. He died at his residence, 8 Chester Place, Regent's Park, London.

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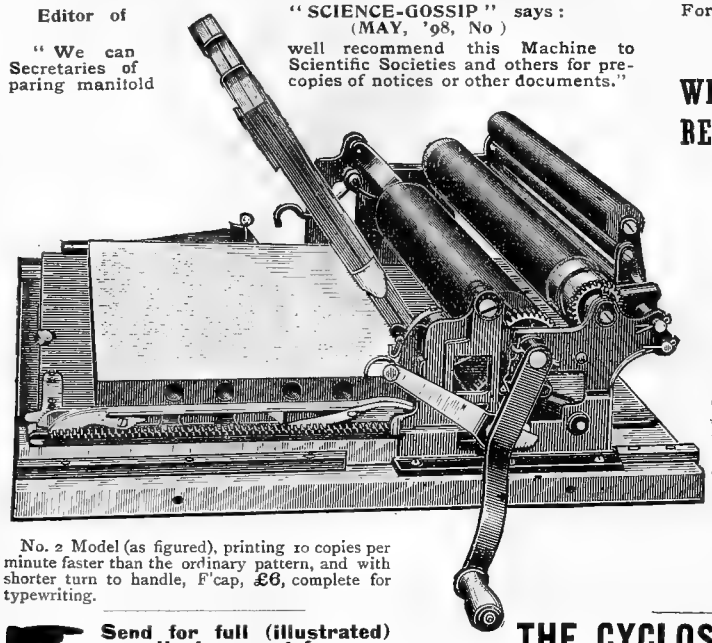

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MICROSCOPY

CONDUCTED BY F. SHILLINGTON SCALES, F.R.M.S.

THE QUEKETT MICROSCOPICAL CLUB.—The November issue of the Journal of the Quekett Club reached us some time ago, but our limited space unfortunately prevented us from noticing it earlier. The good work done for a generation of microscopists by the Quekett Club, the very name of which has a grateful sound in the ears of all ardent lovers of the microscope, requires no mention here. There are several things of interest in this number of the Journal, amongst them being a paper by Mr. C. D. Soar on a water mite that Mr. Soar believes to be a new species, and which he proposes to name *Atax taverneri*, and another paper by Mr. R. T. Lewis on some Australian ticks, each being illustrated by a well-engraved plate. The most lengthy article in the Journal, however, is one that will have an additional interest for our readers. It is by Dr. M. C. Cooke, entitled "Early Memories of the Q.M.C." In the earlier portion he traces the intimate connection that existed between the Club and SCIENCE-GOSSIP. Mr. Cooke begins by calling attention to the work done by the late Mr. Robert Hardwicke as a publisher of scientific books at his house in Piccadilly, from whence issued the "Popular Science Review," and the third edition of that classic work, Sowerby's "English Botany." Mr. Cooke tells us he was a daily visitor to the little shop in Piccadilly, and that he suggested to Mr. Hardwicke that there was a good opening for a cheap monthly magazine devoted to natural history and microscopy, with facilities for exchanges and copious notes and queries. The idea was entertained eagerly, and HARDWICKE'S SCIENCE-GOSSIP was the title suggested by Mr. Hardwicke, and to this he pertinaciously adhered. The first number appeared January 1st, 1865, and became at once a success; in fact, it had no competitor. Mr. Cooke, who was its first editor, and so ably conducted it, adds: "SCIENCE-GOSSIP became the popular magazine of the microscopist. Probably, if there had not been a HARDWICKE'S SCIENCE-GOSSIP there would never have been a Q.M.C." Mr. Hardwicke's manager was Mr. Thomas Ketteringham. The hobbies of the latter gentleman were his microscope and his violin. Once a week Mr. Cooke, Mr. Ketteringham, and his friend, Mr. W. M. Bywater, used to meet at a house in Hanover Square and pursue together their microscopical studies. On May 1st, 1865, a notice was published in SCIENCE-GOSSIP, with the hearty approval of the editor, suggesting the formation of an amateur microscopical society that would cover ground untouched by the Royal Microscopical Society. For this reason the subscription was made as small as possible, and the club itself was formed on July 7th, 1865. It would not be fair to extract more from Mr. Cooke's delightful little paper, which is of interest to others beyond the members of the club. Since then the Quekett Club has done good work for amateur microscopy, and almost as much for microscopy in general, and it still flourishes. Its original foster-mother, SCIENCE-GOSSIP, curiously enough to those who know the Nemesis that overtakes journalistic enterprises, has also proved its staying powers, nor is its influence lessened.

WATSON'S NEW ½-INCH HOLOSCOPIC OBJECTIVE. In a recent number of this Journal (*ante*, p. 183) we noticed two new achromatic objectives by Messrs. Watson & Sons, which were constructed on a new principle, having similar corrections to the apochromatic lenses, and, like them, requiring to be used with compensating or over-corrected eyepieces for their proper correction. This enterprising firm has now sent us for examination a lens which we can only describe as a remarkable one. It is a half-inch of no less N.A. than ·65, which is equivalent to the very high optical index of 31·5. Its spherical and chromatic corrections approximate more closely than we would have believed possible to those of the apochromatics. The finest dry lens at present made is considered to be Zeiss's apochromatic half-inch, and Messrs. Watson's lens has the same power and the same aperture. This in itself is in its way a distinct achievement, as we know of only one other similar lens which exceeds this aperture. But a very careful comparison between the new holoscopic lens and the apochromatic half-inch shows that even on the most difficult and critical tests the achromatic is hardly surpassed by the apochromatic lens. In spherical correction and in definition there is really little to choose between them; but the achromatic lens, as is to be expected, shows, on critical and suitable tests, a slight amount of outstanding colour that is absent in the apochromatic. The objective is corrected for the 250 mm. (10") tube, and bears a 27 compensating eyepiece most satisfactorily. We recommend any of our readers who may be thinking of purchasing apochromatic objectives to examine this lens, and then decide for themselves whether their requirements necessitate their incurring the additional cost of the apochromatic. The price is £3 10s. Messrs. Watson have in hand other similar lenses of the series.

LARVA OF SPONGILLA LACUSTRIS.—The whole of the last part of the "Quarterly Journal of Microscopical Science" is occupied to the extent of 141 pages, illustrated by three double-coloured plates, with an elaborate article on the Structure and Metamorphosis of the Larva *Spongilla lacustris*. It is by Mr. Richard Evans, B.A.

NOTE.—P. 249, first line, for "nose-piece" read "camera-lucida." P. 280, first column, tenth line from bottom, for "March last" read "March next."

ANSWERS TO CORRESPONDENTS.

W. C. B. (Appleby).—1. The small specks in the human blood to which you refer are doubtless those which have been named the elementary particles or blood-tablets. Their uses are not definitely settled. The movement will be the "Brownian" movement. 2. Do not on any account buy second-hand apochromatics unless they have first been returned to Messrs. Zeiss to examine and, if necessary, to rectify. Messrs. Zeiss only guarantee their lenses against atmospheric deterioration. See our notice in this number of a new half-inch by Messrs. Watson. 3. The points you raise will all be dealt with in due course in "Microscopy for Beginners." 4. Why not subscribe direct to London office, and save the delay?

MICROSCOPY FOR BEGINNERS.

By F. Shillington Scales, F.R.M.S.

(*Continued from page* 280.)

We propose now to deal with the elementary management of the microscope and its accessories. The modern microscope has become an instrument of such exquisite precision that the beginner generally finds himself at the very outset in need of explanation and assistance in this respect. A clear understanding of what he is doing is necessary if he is to obtain the best results. In our medical and other laboratories too little attention is often given to these matters, and it follows, therefore, that the student is not really familiar with the use of his instrument, and obtains more or less imperfect results. The general use of the sub-stage condenser has revolutionised microscopy, and we would here call attention most strongly to the fact that the proper management of the illumination of the object is a matter requiring as much or even greater care and attention than the actual focussing of the objective itself. This last is comparatively a simple matter, save where corrections have to be made for diverse thicknesses of cover-glasses.

We will assume that the reader has provided himself with a microscope fitted up in accordance with the rules and suggestions that have been the subject of the preceding papers of this series (1). He will place his microscope on the table before him, and incline it at a comfortable angle for looking down the tube. Of course there is a certain amount of work that can only be done with the microscope in a vertical position; but when the object will admit of it, it is a great convenience and rest to the muscles of the neck if the microscope be slightly inclined. This is a point that makers of even the less expensive foreign microscopes are beginning to realise, and one by one the English improvements are being adopted on the Continent. It will be found that ordinary daylight, though perfectly suitable for low-power work, is unsuitable for high-power and *critical* work, and as we are setting up our microscope for critical work we will deal with lamp-light illumination, accordingly. We need scarcely warn the beginner that the use of direct sunlight is absolutely out of the question for visual purposes. The lamp will be probably an ordinary half-inch paraffin lamp, with a shade, as already described, but without a reflector, as this last only succeeds in confusing the rays of light. Some workers place the lamp on the immediate left of the instrument in order to obviate any glare into the eyes, but the position immediately opposite and in front has so many advantages in ease of manipulation that we prefer this position ourselves, and interpose a cardboard shade if required. The lamp will therefore be placed in the latter position, with its wick turned *edgeways* forward, the light being about 6 to 10 inches or thereabouts from the mirror. It is well to accustom oneself to these approximate distances, as high-power immersion-condensers are adjusted amongst other things for a definite distance of the light from their back lenses. It will be necessary to carefully observe at the outset that the flame is immediately opposite the centre of the stage, and that the tail-rod and the mirror are approximately truly in line with the optic axis of the microscope. This is important. A slight tilting of the mirror will then be sufficient to fill the tube with light. For an objective lower than $\frac{1}{2}$ inch or $\frac{2}{3}$ inch the condenser will not generally be required, and in this case the concave mirror and the flat side of the flame can be used. The concave mirror should be adjusted at such a distance from the object on the stage that the rays of light are approximately focussed on the latter. A little reflection will show our readers that when parallel, or nearly parallel, light falls on a concave mirror the light becomes *convergent*, and the focus will depend upon the curve of the mirror itself. If the condenser be retained for these low-power objectives, the upper lens should be removed or the field of illumination becomes inconveniently circumscribed; but for the reasons just given *the plane mirror must always be used with the condenser*. We have not infrequently seen workers, otherwise experienced, having noticed the increase of light obtained by the use of the concave mirror *without* the condenser, using it for the same purpose *with* the condenser, but forgetting that by so doing they are throwing upon the condenser convergent instead of parallel light, and making it impossible to satisfactorily focus the condenser itself.

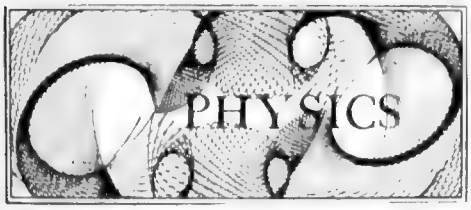
For objectives above $\frac{2}{3}$ inch the use of the condenser is advisable, and for higher powers imperative, if the full value of the objective is to be realised. In Continental microscopes, until recently, a sub-stage condenser was the exception rather than the rule. In many of our English laboratories its use, therefore, is even yet scarcely understood, because of the curious prejudice in favour of the Continental stand; but though the Continental makers turn out excellent objectives, they have only latterly begun to realise that an objective of high aperture has really no advantage over one of low aperture unless used with a suitable condenser.

Having so arranged lamp and mirror that the object is properly illuminated, it will be necessary then to focus the objective upon the slide, and, having done that, to adjust the condenser up or down, until the image of the edge of the lamp flame appears distinctly in the centre of the field. The light is thus correctly adjusted, its rays being brought to a focus upon the object, and so entering the objective undisturbed. To a beginner, the partially-illuminated field seems strange; but he must remember that in a critical image it is necessary to get the maximum perfection of definition in that portion of the object immediately under examination, and the rest may be ignored. If, however, a larger field be required, the flame, having been focussed, can then be turned broadside on, without altering its other positions. For ordinary work this is usual.

In earlier days it was customary, after focussing the light, to rack the condenser either up or down until the field was fully illuminated, and we have heard that the Quekett Club, which has done so much for amateur microscopists, held two vehement rival schools, one of which maintained that the condenser should be racked up and the other that it should be racked down. All these matters have now been settled by the realization of the real principle, and even more, perhaps, by the improvement in objectives, by which, under such illumination as now obtains, hidden structure has been brought to light that was before not even suspected. It may be well to warn beginners against racking the condenser so high as to drive the slide up against a high-power objective.

(*To be continued.*)

(1) This series of articles on the Microscope commenced in the July 1899 number of Science-Gossip.



CONDUCTED BY JAMES QUICK.

ARTIFICIAL FLIGHT.—Two of the recent Friday evening discourses at the Royal Institution have been of special interest to physicists. The first, which was the opening one of the present series, was given on January 19 by Lord Rayleigh on "Flight." After describing the many aeroplanes devised to illustrate the action of flying, amongst which the Malay kite is one of the simplest, as it does not possess a tail, Lord Rayleigh went on to observe that the best form is that known as the Hargrave kite. This is a peculiarly shaped instrument, more like a rectangular skeleton box, partly covered with calico, than an ordinary kite. It is, however, very stable in the air, as it depends on side vanes, which, when the kite gets a little out of the wind, tend to bring it back again. The kite was introduced some years ago by Mr. Archibald for meteorological work, and more recently by Major Baden-Powell, now of South African fame, who has done excellent work in connection with the use of the kite for military purposes. He has succeeded in raising a man from the ground by means of a kite, and has shown that kites could be made useful for reconnoitring purposes. The essential question in connection with the kite is the action of the wind on the aeroplane, but it is different with the flying-machine, which, unlike the kite, is free and unattached to the ground. In regard to the flight of birds, a difference is observable between that of small and large ones. A pigeon, for instance, works exceedingly hard, by means of vigorous flapping of wings, to raise itself to the top of a building; whereas the big soaring or sailing flight birds are able to maintain themselves in the air for a considerable time with little or no flapping of the wings or muscular effort. The question of how this soaring is maintained is still a debated one. Naturalists are unable to appreciate the mechanical difficulty; and mechanics say that a bird cannot maintain itself in the air when the latter is moving in a perfectly uniform, horizontal manner. There must be a vertical component. Birds take advantage of the relative motion of the different parts of the air they encounter. Those like the albatross take the benefit of the gustiness of the wind. Not only is there pressure underneath the wing of the bird, but suction on its upper surface. If a man raises himself in the air and he is not to fall there must be a downward current of air caused by a screw, and the question is what must be the size of the screw and the work to be done in order that a human being may be supported. Careful considerations show that it is impossible for him, by his own muscular power, to support himself by means of a screw. A bird has an advantage in point of size, and the wings a man would require, if he is to fly with them, would be absurdly large. In the same way the size of a screw would have to be out of proportion to anything that could be managed. Mr. Hiram Maxim has said that it is only a question of money.

SPACE TELEGRAPHY.—The second physical lecture referred to was given at the Royal Institution on February 2nd by Signor Marconi before a crowded audience, the subject, as may be expected, being "Wireless Telegraphy." He sketched in outline the general work that he and his assistants have been doing for the last two years or more. Alluding to the installation of his system between the South Foreland and the Goodwin Sands Lightship, he said the experiments had shown that wireless telegraphy was reliable and certain in operation. He hoped that before long the Trinity House authorities would be enabled to establish communication all round the coast with lightships and lighthouses, by means of which a vast amount of property and many lives might be saved. Signor Marconi then mentioned how, when last returning from America, he opened up wireless communications between the ss. "St. Paul" and one of his signalling stations on the south coast, when the vessel was sixty miles from land and steaming at twenty knots an hour. At the tardy request of the War Office some of his assistants with instruments were sent to South Africa, and arrived at De Aar camp on December 11th. Finding no arrangements made for a supply of the necessary poles, &c., they manufactured, with the hearty assistance of Major Baden-Powell and Captain Kennedy, some kites with which they got over the difficulty. The results at first were not very satisfactory, but eventually communication was established between De Aar and the Orange River, a distance of over seventy miles. Stations were then established at Modder River, Belmont, Orange River, and De Aar. They had worked well, and would be invaluable in case the field lines should be cut by the enemy. Signor Marconi said he found it hard to believe the Boers possessed any wireless telegraphy instruments. Some intended for them were seized at Cape Town, but they were found to be of foreign manufacture. He remarked he need hardly add that no apparatus had been supplied by him to anyone from whom the Boers could possibly obtain them. The lecture was illustrated by diagrams and a number of lantern slides. Without wishing in any way to lessen the credit due to Marconi for his work in this most important subject, his lecture cannot be considered in quite good taste. Had the title been "Marconi Telegraphy," the *résumé* would have been a perfect one. Not a single word was said, however, about other workers and other methods; yet these workers include some of the leading physicists and engineers in the world, and their methods, though differing perhaps from that of Marconi, aim at the same result. Surely one would think that at a Royal Institution gathering the solid work of such men as Preece and Lodge should at least have been mentioned.

A PILOT TORPEDO.—The method of protecting special trains from collision by means of a pilot engine has been further practised by the introduction of a specially designed electrical pilot torpedo to protect ships at sea from collision. Its shape resembles that of a Whitehead torpedo, and it is connected to the ship it is to protect by means of two pairs of wires. One pair convey the current to the torpedo for driving the motors connected with the screw propellor; the other pair are in circuit with an alarm-bell on the ship, and with two special "feelers" at the head of the torpedo, this circuit being closed when the "feelers" collide with anything. Immediately this happens, a special arrangement reverses the direction of rotation of the motors, making the torpedo recoil. It is not clear how the torpedo is steered.

CONDUCTED BY F. C. DENNETT.

1900. Mar.	*Rises.* *h.m.*	*Sets.* *h.m.*	*Position at Noon.* *R.A.* *h.m.*	*Dec.* ° ′
Sun .. 1 ..	6.48 a.m. ..	5.38 p.m. ..	22.48 ..	7.39 S.
11 ..	6.25 ..	5.55 ..	23.25 ..	3.46
21 ..	6.2 ..	6.12 ..	0.2 ..	0.10 N.
31 ..	5.40 ..	6.29 ..	0.38 ..	4.5

Mar.	*Rises.* *h.m.*	*Souths.* *h.m.*	*Sets.* *h.m.*	*Age at Noon.* *d. h. m.*
Moon 1 ..	6.18 a.m. ..	0.7 p.m. ..	6.12 p.m.	0 0 35
11 ..	1.14 p.m. ..	8.58 p.m. ..	4.2 a.m.	10 0 35
21 ..	..	3.30 a.m. ..	7.42 a.m.	20 0 35
31 ..	5.28 a.m. ..	0.33 p.m. ..	7.56 p.m.	0 15 30

Mar.	*Souths.* *h.m.*	*Semi-Diameter.*	*Position at Noon.* *R.A.* *h.m.*	*Dec.* ° ′
Mercury .. 1 ..	1.11 p.m. ..	3.0″ ..	23.46 ..	1.9 S.
11 ..	1.10 p.m. ..	4.0″ ..	0.25 ..	5.32 N.
21 ..	0.26 p.m. ..	5.3″ ..	0.20 ..	5.58
31 ..	11.20 a.m. ..	5.6″ ..	23.53 ..	1.12
Venus .. 1 ..	2.35 p.m. ..	7.4″ ..	1.10 ..	7.34 N.
11 ..	2.39 p.m. ..	7.8″ ..	1.54 ..	12.28
21 ..	2.44 p.m. ..	8.3″ ..	2.38 ..	16.54
31 ..	2.50 p.m. ..	9.9″ ..	3.23 ..	20.41
Mars .. 11 ..	11.27 a.m. ..	2.0″ ..	22.42 ..	9.27 S.
Jupiter .. 11 ..	5.22 a.m ..	17.8″ ..	16.36 ..	21.10 S.
Saturn .. 11 ..	7.4 a.m. ..	7.5″ ..	18.18 ..	22.23 S.
Uranus .. 11 ..	5.30 a.m. ..	1.7″ ..	16.44 ..	22.15 S.
Neptune .. 11 ..	6.19 p.m. ..	1.2″ ..	5.35 ..	22.4 N.

MOON'S PHASES.

		h.m.			*h.m.*
New ..	Mar. 1 ..	11.25 a.m.	*1st Qr.* ..	Mar. 8 ..	5.34 a.m.
Full ..	,, 16 ..	8.12 a.m.	*3rd Qr.* ..	,, 24 ..	5.36 a.m.
New ..	,, 30 ..	8.30 p.m.			

In perigee, March 1st at noon; in apogee on 15th at 1 a.m.; and in perigee again on 29th at 11 p.m.

METEORS.

				h.m.		
Mar.	..	β Leonids	.. Radiant	11.40	Dec.	10° N.
,, 1–4	..	τ Leonids	.. ,,	11.4	,,	5° N.
,, 1–28	..	κ Cepheids	.. ,,	20.32	,,	78° N.
,, 24	..	β Ursids	.. ,,	10.44	,,	58° N.

CONJUNCTIONS OF PLANETS WITH THE MOON.

					° ′
Mar. 2	.. Mercury	.. 6 p.m.	.. planet		4.37 S.
,, 4	.. Venus*	.. 8 a.m.	.. ,,		3.58
,, 22	.. Jupiter*†	.. 1 p.m.	.. ,,		1.8 N.
,, 24	.. Saturn*	.. 8 a.m.	.. ,,		0.49 S.
,, 29	.. Mars†	.. 10 p.m.	.. ,,		6.29 S.
,, 30	.. Mercury*	.. 7 a.m.	.. ,,		2.59 S.

* Daylight. † Below English horizon.

OCCULTATIONS AND NEAR APPROACHES.

Mar.	*Star.*	*Magnitude.*	*Disappears.* *h.m.*	*Angle from Vertex.* °	*Reappears.* *h.m.*	*Angle from Vertex.* °
8.	Neptune ..	..	6.13 p.m. ..	107 ..	7.34 p.m. ..	249
11.	*f* Geminorum	5.2 ..	1.43 a.m. ..	57 ..	2.40 a.m. ..	260
16.	*e* Leonis ..	5.1 ..	3.20 a.m. ..	64 ..	4.25 a.m. ..	279
22.	ρ Ophiuchi ..	5.3 ..	5.19 a.m. ..	165 ..	5.33 a.m. ..	183
24.	Saturn ..	..	8.35 a.m. ..	56 ..	9.46 a.m. ..	225

THE SUN is frequently quite free from spots; but should nevertheless be watched, as considerable spots, and even groups, sometimes occur.

MERCURY at the beginning of the month is an evening star, reaching its greatest elongation, 18° 16′ east, at 11 a.m. on March 8th. It is then favourably situated for observation in the constellation Pisces, and sets about an hour and three-quarters after the sun. It is in inferior conjunction with the sun at 3 a.m. on March 25th.

VENUS is well placed for observation all the month, being an evening star, setting some four hours later than the sun. It begins the month in Pisces, but about the 8th passes into Aries.

MARS is too near the sun for observation.

JUPITER is a morning star situated just a little east of ω Ophiuchi.

SATURN is a morning star situated slightly to the east of a line joining μ and λ Sagittarii. It is unfortunate that daylight will arrive before the occultation of Saturn on the 24th of March.

URANUS is also a morning star, situated a little south-east of Jupiter.

NEPTUNE is still situated just north-east of ζ Tauri, and must be looked for early in the evening. Effort should be made to observe the occultation on March 8th.

THE ZODIACAL LIGHT may be looked for in the eastern sky as soon as it is dark enough. It has already been seen several times this year by different observers, including Colonel E. E. Markwick, at Devonport.

THE CAMBRIAN NATURAL OBSERVER, the quarterly journal of the Astronomical Society of Wales, for January, is to hand. It contains reports of observations on the lunar eclipse of December 16th, as well as of attempted observations on the Leonids. The Society seems to be making vigorous progress.

A NEW COMET (*a* 1900) has been discovered by M. Giacobini of the Nice Observatory, and since observed by M. Javelle of the same observatory. On the evening of February 3rd it was situated in R.A. 2 h. 49 m. 51s., S. Declination 6° 40′ 10″ just between the constellations of Cetus and Eridanus, travelling in a north-westerly direction. This leads to its being lost amid the solar brilliance.

THE SUN has during the last half of January and the beginning of February been exerting a considerable amount of energy, no less than fifteen spots, some of them conspicuous, being recorded on one day.

THE ROYAL ASTRONOMICAL SOCIETY has chosen Mr. Edward Ball Knobel for its new President in succession to Professor G. H. Darwin, F.R.S. Its gold medal has been presented to M. Poincaré for his researches in the mathematical theory of rotating fluid bodies, which have a bearing upon the figure of our earth and its oceanic tides. Professor Darwin, in the presence of the French Ambassador, gave an excellent address, explaining the reason for the award. He described M. Poincaré's researches and pointed out that, like some other mathematicians, the recipient of the medal has much advanced, on new lines, the solution of the Problem of Three Bodies. This may be described as the accurate determination of the earth's moon under the attractive force of the sun and earth.

REFLECTING TELESCOPES.—At the meeting of the British Astronomical Association at Sion College on January 31st, Mr. Edwin A. Holmes read a paper in which he endeavoured to show that M. Schaeberle's investigations with regard to reflectors were not wholly right in the conclusions arrived at. The image produced at the focal point is not a series of images superposed, but the resultant image produced by the entire objective.

CHAPTERS FOR YOUNG ASTRONOMERS

By Frank C. Dennett.

(*Continued from page 284.*)

MERCURY.

The innermost of the Sun's planets has a diameter of only 3,008 miles, so that no less than eighteen such globes would be needed to make up one the size of our own world. It would, however, only want fifteen such globes to weigh down our earth; yet from the smallness of Mercury, a stone dropped on its surface would only fall 7 feet in a second instead of 16 feet on our earth. From its proximity to the Sun, being never more than 29° distant, it is not so easily seen as the other members of our system. The best opportunities are when it reaches greatest elongation east in May or June, or greatest elongation west in July or August. The writer has, at these periods, readily seen Mercury even in smoky London, shining as a bright rosy-tinted star. Knowing where to look is the secret of successful search. The beautifully clear skies in the East doubtless account for the detection of Mercury by the ancients. The oldest record we have dates back to 265 B.C. On the other hand, the vapours near the horizon on the banks of the Vistula, as was long since pointed out by Gassendi, were the probable reason for Copernicus failing.

Its greatest apparent diameter, when it is in transit over the sun's disc, is about 11″·5; whilst at the time of superior conjunction, when it shines like a little full moon, its diameter dwindles down to 4″·5, the difference being shown by the diagram. When in the best position for observation it appears very like a half-moon.

It is not a satisfactory object to observe when near the horizon, as the atmosphere is seldom steady enough or sufficiently clear to permit of good observations being made. Observations should be attempted when it is high in the sky during daytime. This is not really so difficult a matter as may at first appear, even with the ordinary altazimuth stand, whilst with an equatorial stand and circles it is comparatively easy. To find an inferior planet in daytime with an altazimuth telescope, I choose the time when it is near the meridian, and then set the telescope pointing south. Of course every telescopist knows the south point from his place of observation. Then, by the help of an ordinary protractor, raise it to the approximate altitude. A large field eye-piece of low power, say 30 to 45, must be put on the telescope. Slightly raise the instrument three or four degrees, and sweep it along east and west a few degrees. Then gradually lower it, sweeping at each lowering, and very soon the planet will be seen in the field of view, and higher powers may be substituted.

An ordinary fine day is, however, often very unsatisfactory for such a search, because the amount of vapour in the atmosphere reflects such a quantity of sunlight as to almost or quite blot out the planet from view. Days should be selected when the sky is deep blue.

Sometimes the planets draw so near to each other as to be both seen together in the same telescopic field. Once in May, 1737, Bevis, at Greenwich, actually witnessed the occultation of Mercury by the planet Venus. When thus near each other, the relative brilliance of the planets can be compared. On September 26th, 1878, Nasmyth compared these two. Whilst Venus was said to be equal to clean silver, Mercury was nothing better than lead or zinc. This indicates that the former must have much the highest reflecting power, since, area for area, Mercury receives about 3½ times greater light.

Very little has been revealed concerning this planet even by the most powerful telescopes, so that, in fact, little more is known now than when Schroter observed it about a century ago. Its most marked characteristics are the phases. One peculiarity has been noticed about these which is a puzzle to astronomers, the bright portion appearing narrower than calculation would lead them to expect. This phenomenon has been seen by many observers, both in the cases of Mercury and Venus; but up to the present time no satisfactory explanation has been given.

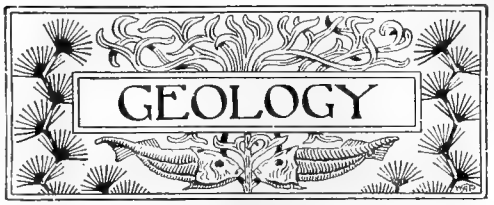
So far as surface detail is concerned, we know very little. Schröter and his assistant, Harding, considered that the surface was mountainous, because from time to time the southern horn appeared blunted off. Likewise projections were seen, and irregularity of the terminator. He inferred that some of the mountains must have a height of at least eleven miles. This blunting of the horn has been confirmed by many observers since the days of Schröter. From various observations a rotation period of 24h. 5m. 28s. was obtained. An atmosphere was inferred from the occasional appearance of dusky streaks and spots. Prince and Noble have noted the appearance of dark spots, and Birmingham of a bright one. Schiaparelli

Mercury at Greatest and Least Diameters.

has fancied brownish streaks on the planet, permanent in their positions. He arrived at the startling conclusion that Mercury only turns once on its axis during about 88 days, the time occupied in travelling round the sun.

From time to time Mercury passes between the earth and sun. Then he appears as a circular black spot on the disc. Thus seen, some observers have fancied that a greyish border surrounded the planet, others, at the same time, thinking that a bright bordering was to be seen. Another peculiarity noticed is that when in transit many observers fancy the presence of one, and some two, bright spots near the centre of the planet's black disc. Whether these appearances are real or only optical illusions seems for the present to remain uncertain. One optical illusion generally observed at the time of transits is that known as the "black-drop," the planet appearing lengthened out to the sun's limb at the times of ingress and egress. This is due to irradiation, the bright sun appearing too large and the black planet too small in contrast. The spectroscope of Vogel seemed to demonstrate the presence of an atmosphere containing watery vapour. Yet there are those who would have us believe that, owing to the small mass of Mercury, his gravitation power is so slight that he cannot retain even water on his surface.

(*To be continued.*)



CONDUCTED BY EDWARD A. MARTIN, F.G.S.

STRIAE AS EVIDENCE OF ICE ACTION.—We regret that, owing to an unfortunate omission, the note under this heading last month was not signed. It should have been by Mr. J. Sheppard, 78 Sherbourn Street, Hull.

GEOLOGICAL EXCHANGE MEETING.—The next exchange meeting will take place on Wednesday, March 7th, from 5.15 P.M. to 7 P.M. Amongst specimens awaiting to be exchanged are fossils from the Upper Greensand of Faringdon, Gault of Folkestone, Oligocene of Colwell Bay, Eocene, etc. An exchanger asks for specimens of travelled blocks, erratic boulders, flakes, or information relating to them.

A PALAEOZOIC ICE-AGE.—Some interesting remarks by Professor Edgeworth David, of Sydney, on evidence of glaciation in Permo-carboniferous times in New South Wales, prefaced the papers which were down for reading on February 7th at the meeting of the Geological Society of London. Three boulders were exhibited bearing striations which were considered as undoubted evidence of ice-action. The striae on the largest boulder were in all directions, some crossing others at an angle of as much as 85°. Very great doubt has recently been cast on the evidences of a glacial period in Permian times in Britain, but in Australia there seems little doubt of its existence in Palaeozoic times. Professor David reports, indeed, striated boulders from the very tropics of Australia.

CHALK PLATEAU EOLITHS.– Whatever may be the final result of the discussion which is being widely debated at the present time, as to the authenticity or otherwise of the Eolithic flint implements, those who believe them to be true specimens of man's handiwork are certainly leaving no effort unmade in the direction of procuring all possible evidence in favour of the point at issue. Over 3,000 of these implements have been found from the chalk plateau of North Kent. This, as is well known, is the ground where the first specimens were discovered, which gave rise to a belief in the evidence of plateau, or Eolithic man. The supporters of the theory had the staunch support to the end of the late Professor Prestwich, who, in September 1893, wrote to his friend Sir John Evans, "I am more satisfied than ever of the great antiquity of the chalk plateau specimens." Prestwich felt assured that the belief which he possessed in these implements would in the end prevail. He had lived through the time when geologists were sceptical of the human workmanship of the Acheul and Amiens implements, in the placing of which in their true light he had so large a measure of success. He had no doubt whatever that the authenticity of the rude plateau implements would in the end be agreed upon. He was fond of pointing out that although one might have reasonable doubts when a single specimen was viewed, and although his supporters were divided amongst themselves as to which were authentic implements and which were not, yet when a selection was placed in sequence, commencing with the rudest, and working gradually towards the recognised Palaeolithic type, the evidence was at once striking, and seldom failed to carry conviction that there was such a type of implement as the "Eolith." These flaked flints have often been attributed to natural causes, but as Mr. A. S. Kennard pointed out in 1898, no attempt has been made to show what were those causes, and how and when they operated. There seems, in fact, to be almost unanimity of opinion that the Eoliths are genuine plateau-gravel flakes, and that many, if not most of them, were worked by man. Man has therefore been carried back to an existence during or previous to the deposition of the plateau gravels, for the flints must have been flaked before the gravel which contains them was deposited. Mr. A. E. Salter would like to believe that the gravels are of Pliocene age, but proof of this is wanting, although the Rev. Ashington Bullen, the co-worker in recent years with Prestwich, is satisfied of their Pliocene age. Prestwich, however, said that the plateau drift "dates from a time subsequent to the Pliocene period, though still when the beds of that age had a wider range southward, and anterior to the Glacial period." Also that it "must therefore be of Pre-glacial or early Glacial age." What, however, still appears to be wanting, is evidence that these implements are not really merely Palaeoliths, and that there is no possibility of the Eolithic markings being of subsequent workmanship to the Palaeolithic flaking. Whatever may be the credit attached to the discovery of this rude type of implement, such will always remain due to Mr. Benjamin Harrison. Prestwich was anxious to give the discoverer his due, as the following letter will show, quoted from the recent "Life of Sir Joseph Prestwich." He writes to Mr. Harrison:—"You should have told your inquirer who asked you why you did not at first write about the plateau implements, that long ago I asked you whether you would not do so."—*E. A. Martin.*

WHAT IS OLDHAMIA?—We ventured to suggest in SCIENCE-GOSSIP some time ago that very possibly the Cambrian fossils known as *Oldhamia radiata* and *O. antiqua* might prove after all to be merely the remains of rock-markings, and not organisms at all. Professor Sollas, of Oxford University, has been extending his researches into this question, and microscopical observations which he has made prove, in his opinion, that *Oldhamia* is not the remains of an organism, but merely a marking on the rock, although these markings may still have been of organic origin. Certain markings on the mud at Portishead, by the feeding habits of a small burrowing crustacean, bear a considerable resemblance to specimens of *Oldhamia*. Professor Sollas is inclined to believe that they are traces of some kind of siphonaceous alga, the cavities left by their decay being subsequently filled in by sediment under pressure. If the surface of *O. antiqua* were more resistant than the lower, this might account for its preservation in relief. Professor Joly observed that *O. antiqua* always occurred in relief, whilst those of *O. radiata* are depressions. There has been much discussion in the past as to the place of *Oldhamia* in the organic world, it being placed by different observers amongst the polyzoa, the hydrozoa, as well as in the vegetable world. It would be an interesting, and it might prove a useful, subject for observation during the holidays, for our readers to note the impressions made by storm-blown seaweeds upon the sand. It will be seen that *O. antiqua* appears in the ornamental heading of our geological columns.—*E. A. Martin.*

REARING DEATH'S-HEAD MOTHS.—Last autumn more than the average number of larvae and pupae of *Acherontia atropos* were taken in England. They were, as usual, found chiefly in potato fields. It is to be feared that a large proportion of these captive pupae will be lost during the coming winter in consequence of want of experience in artificially forcing them into the imago stage. This process is a simple one, and it may be broadly stated that without its help very few pupae of the rarer sphinx moths can be successfully reared to maturity in Britain. Those who practise the system regularly seldom lose a single specimen. Take an ordinary large flower-pot; one about 10 in. wide is best. Fill it with earth which has been baked in an oven sufficiently to kill any predatory creatures. Cover this with a thick layer of moss that has been scalded in boiling water for the same reason. Then place the pupae on the top of the earth under the moss, room having been left between the top of the moss and the glass cover for the moths to develop their wings. Keep the earth and moss damp, but not wet, until the moths appear. The flower-pot with its contents must be kept in a warm greenhouse, or on a kitchen mantelpiece where there is a regular fire, for six weeks, when the moths will begin to appear almost certainly to the day.—*John T. Carrington, December 1st*, 1899.

CLEANING CORAL.—Place the coral in a pan of boiling water. Then add spirits of salts, about ¼ lb. to 2 gallons of water. Take out the coral, and immediately rinse it in cold water.—*J. E. Linter, Twickenham.*

CLEANING CORAL.—I have cleaned corals with hydrochloric acid in the following manner:—Take an earthenware pan containing sufficient water to cover the coral. Add to this enough acid to make the coral slightly effervescent when put into the mixture. The acid should previously have been well mixed with the water and allowed to stand for a few minutes. The effervescent action on the coral will release most of the dirt. The coral should not be allowed to stay in the mixture long enough to destroy the sharpness of structure Then hold the specimen under a strong current of water from an ordinary tap, using a tooth-brush or any other suitable to remove dirt remaining. If not sufficiently clean from the first operation, repeat the process, when the coral will become as white as snow.—*Thomas Edwards, Equity Road, Leicester.*

ARION ATER VAR. BOCAGEI IN IRELAND.—In the "Journal of Malacology," vol. vii. p. 33, this Portuguese form of the common black slug is recorded from the South of Ireland, which already possesses at least one other Portuguese slug. Dr. Scharff very properly points out in the "Irish Naturalist" that in giving this record the editor of the "Journal of Malacology" refers to *A. ater* as *A. empiricorum*, and disagrees with Mr. Collinge in the nomenclature.

NATURAL HISTORY SOCIETY OF GLASGOW.—At the fifth meeting of the forty-ninth session, held in the Society's rooms, 207 Bath Street, on 1st February, Mr. Alexander Somerville, B.Sc., F.L.S., occupied the chair. On behalf of Professor G. F. Scott Elliot, M.A., F.L.S., &c., there was exhibited by Mr. J. Wylie a collection of sixty-four species of *Mycetozoa*—presented to Professor Elliot by Mr. Arthur Lister, F.R.S.—and Mr. Wylie read a paper treating of the group. Mr. Charles Kirk exhibited the common buzzard, *Buteo vulgaris* Leach, from the Crieff district. This large hawk, which has all the appearance of a miniature eagle, was at one time common throughout Scotland, but has for so long been trapped and shot that it is now scarce. It feeds on small quadrupeds, birds, and reptiles, and is of service to the farmer in driving away wild pigeons. According to the late Robert Gray, it is the kind of instrument required for clearing off sickly young game-birds, and so improving the breed. Mr. Lumsden, writing in 1876, states that the buzzard nests in the neighbourhood of Loch Lomond. Dr. J. F. Gemmill, M.A., brought forward and described an unusually large-sized skull of a polar bear, *Ursus maritimus* Desmarest, shot near Hamilton Gulf, Greenland, lent for exhibition by Mr. Adam Wood, Troon. Dr. Gemmill indicated the chief characteristics of the skulls of carnivores in general, and of bears in particular, and pointed out that the specimen on view showed some individual peculiarities, the result in all probability of an early and severe injury. Mr. James Mitchell, who had recently visited the Cape, exhibited a fine series of horns of South African antelopes, including those of the eland, koodoo, gemsbok, and springbok, and he read a paper describing these animals.

NORTH LONDON NATURAL HISTORY SOCIETY.—The eighth annual exhibition of the North London Natural History Society was held on December 30th, 1899, and January 1st, 1900. The Committee again secured the services of Mr. R. B. Lodge, of Enfield, who, on the first evening, gave a most interesting lantern lecture on "British Birds at Home and Abroad." Mr. J. W. Tutt, F.E.S., lectured on the second evening on "Protective Colouration and Mimicry in Animal Life," illustrating his instructive and entertaining remarks by means of numerous lantern slides. Exhibits in the Entomological section were scarcely as numerous as on some previous occasions, but they included some well-illustrated life-histories of Lepidoptera by Messrs. C. Nicholson and A. Quail, as well as a number of Lepidoptera by Mr. L. B. Prout and others. There was also a good show of exotic Lepidoptera, among which Mr. Bacot's insects from South Africa were specially interesting. Other branches of zoology were well represented. Some well-mounted birds, lent by Drs. S. Wilson and J. S. Sequeira, and fine examples of amateur taxidermy were contributed by Mr. D. C. Barber; all the birds exhibited, including a British-killed specimen of the common bittern (*Botaurus*

stellaris), being his own mounting. A good representative collection of British birds' eggs was lent by Messrs. Cottrell, Hills, Lane, Lovis, and others. Mr. F. E. Williams contributed an interesting exhibit of mammals' skulls, and Messrs. J. B. Crane, F. B. Jennings, and J. Wheeler exhibited mollusca. Mention must also be made of an excellent series of clever watercolour drawings of various reptiles, taken from the life by Mr. F. W. Jones. The botanical exhibits included a large number of dried plants, among which may be mentioned *Helianthemum marifolium*, *Saponaria vaccaria*, and *Carex pseudo-cyperus*, by Mr. L. B. Hall; *Calluna erica*, var. *incana*, *Juncus acutus*, and *Hymenophyllum tunbridgense*, by Mr. R. W. Robins; also *Mentha rubra*, *Scilla verna*, and *Inula crithmoides*, by Mr. C. S. Nicholson. In addition, Mr. H. Elms showed a large and interesting collection of specimens representing the sources of drugs used in the British Pharmacopoeia, and Mr. Milton, a pine-needle ball, formed by the action of water in Scotch lakes. Numerous microscopes were on view during both evenings, including that of Mr. F. P. Smith, who showed and explained original preparations illustrating the economy and anatomy of spiders.—*C. Nicholson, Hon. Sec. Exhibition Committee.*

NOTICES OF SOCIETIES.

*Ordinary meetings are marked †, excursions *; names of persons following excursions are of Conductors. § Lantern Illustrations.*

ROYAL INSTITUTION OF GREAT BRITAIN.

1900.

Mar. 1.—†§Recent Excavations in Greece. C. D. Waldstein, Litt.D., Ph.D., L.H.D., at 3 P.M.
,, 2.—†Malaria and Mosquitoes. Major Ronald Ross, D.P.H., M.R.C.S., at 9 P.M.
,, 3.—†Polarised Light. Right Hon. Lord Rayleigh, M.A., D.C.L., F.R.S., LL.D., at 3 P.M.
,, 6.—†Fishes. Professor E. Ray Lankester, LL.D., F.R.S., at 3 P.M.
,, 8.—†§Recent Excavations in Greece. C. D. Waldstein, Litt.D., Ph.D., L.H.D., at 3 P.M.
,, 9.—†Bacteria and Sewage. Professor Frank Clowes, Sc.D., F.C.S., at 9 P.M.
,, 10.—†Polarised Light. Lord Rayleigh, at 3 P.M.
,, 13.—†Fishes. Professor Ray Lankester, at 3 P.M.
,, 15.—†Recent Excavations in Greece, at 3 P.M.
,, 16.—†§Pictorial Historical Records. Sir Benjamin Stone, at 9 P.M.
,, 17.—†Polarised Light. Lord Rayleigh, at 3 P.M.
,, 20.—†Fishes. Professor E. Ray Lankester, at 3 P.M.
,, 22.—†The Highest Andes. E. A. Fitzgerald, F.L.S., F.R.G.S., at 3 P.M.
,, 23.—†Paper. Sir Andrew Noble, at 9 P.M.
,, 24.—†Polarised Light. Lord Rayleigh, at 3 P.M.
,, 27.—†Fishes. Professor E. Ray Lankester, at 3 P.M.
,, 29.—†The Highest Andes. E. A. Fitzgerald, at 3 P.M.
,, 30.—†Facts of Inheritance. Professor J. Arthur Thomson, M.A., at 9 P.M.
,, 31.—†Polarised Light. Lord Rayleigh, at 3 P.M.

Frederick Bramwell, Hon. Sec., Albemarle Street, W.

SOUTH LONDON ENTOMOLOGICAL AND NATURAL HISTORY SOCIETY.

Mar. 8.—†§Cockroaches: Natives and Aliens. Mr. W. J. Lucas, B.A., F.E.S.
,, 22.—†Microscopical Evening.

Stanley Edwards, Hon. Sec., Hibernia Chambers, S.E.

LAMBETH FIELD CLUB AND SCIENTIFIC SOCIETY.

Mar. 5.—†Norman Architecture. C. H. Dedman.
,, 17.—*Botanical Section, Science Galleries, South Kensington.
,, 19.—†Gossip Meeting. The Poetry of Nature. J. S. Clough.

F. P. Perks, Hon. Sec., 41 St. Martin's Lane, W.C.

THE SIDCUP LITERARY AND SCIENTIFIC SOCIETY.

Mar. 6.—†Roman Occupation in Britain. H. Lawrance, M.A.
,, 20.—†Early Days and Art Teaching of John Ruskin. W. L. Shand.

S. E. Curry, Hon. Sec., Brighton Villa, Main Road, Sidcup.

HAMPSTEAD ASTRONOMICAL AND SCIENTIFIC SOCIETY.

Mar. 2.—†Nature's Forces. E. Compson Crump.

Basil W. Martin, Hon. Sec., 7 Holly Place, Hampstead.

NOTICES TO CORRESPONDENTS.

TO CORRESPONDENTS AND EXCHANGERS.—SCIENCE-GOSSIP is published on the 25th of each month. All notes or other communications should reach us not later than the 18th of the month for insertion in the following number. No communications can be inserted or noticed without full name and address of writer. Notices of changes of address admitted free.

BUSINESS COMMUNICATIONS.—All Business communications relating to SCIENCE-GOSSIP must be addressed to the Proprietor of SCIENCE-GOSSIP, 110 Strand, London.

EDITORIAL COMMUNICATIONS, articles, books for review, instruments for notice, specimens for identification, &c., to be addressed to JOHN T. CARRINGTON, 110 Strand, London, W.C.

SUBSCRIPTIONS.—The volumes of SCIENCE GOSSIP begin with the June numbers, but Subscriptions may commence with any number, at the rate of 6s. 6d. for twelve months (including postage), and should be remitted to the Office, 110 Strand, London, W.C.

NOTICE.—Contributors are requested to strictly observe the following rules. All contributions must be *clearly* written on one side of the paper only. Words intended to be printed in *italics* should be marked under with a single line. Generic names must be given in full, excepting where used immediately before. Capitals may only be used for generic, and not specific names. Scientific names and names of places to be written in round hand.

THE Editor is not responsible for unused MSS., neither can he undertake to return them unless accompanied with stamps for return postage.

ANSWERS TO CORRESPONDENTS.

H. G. (London, W.C.).—The subject is so vast that there is no one book that could be recommended from which the names of all recent and fossil shells could be found. In SCIENCE-GOSSIP for June, p. 40, the Editor gave a list of works dealing with recent mollusca. The simplest way, if many shells are to be named, is to take them to the galleries of the Natural History Museum at South Kensington.

EXCHANGES.

NOTICE.—Exchanges extending to thirty words (including name and address) admitted free, but additional words must be prepaid at the rate of threepence for every seven words or less.

EXCHANGE wanted in microscopic or lantern slides for forty-six parts of "Familiar Wild Flowers," first edition, containing ninety-two old plates. Also for British Eocene, Oligocene, and Gault fossils.—E. A. Martin, 23 Campbell Road, Croydon.

OFFERED. The Druggist General Receipt Book, Beasley's Ninth edition. Wanted Canadian stamps or Foreign shells.—William Gomm, Hotel du Canynge, Redcliffe Street, Bristol.

ENTOMOLOGIST'S ANNUAL, complete set; Entomologists' Record, Ent. Monthly Magazine, several vols., and many other entomological and scientific works. Wanted Jeffery's "British Conchology," Sowerby's Illustrated Index.—C. S. Coles, The Pheasantries, Hambledon, Hants.

WANTED, offers for two nests weaving birds from Burmah, several fine pieces Gorgonia flabellum; several pairs good Norwich canaries, and large aviary 7 feet high.—H. W. Parritt, 8 Whitehall Park, N.

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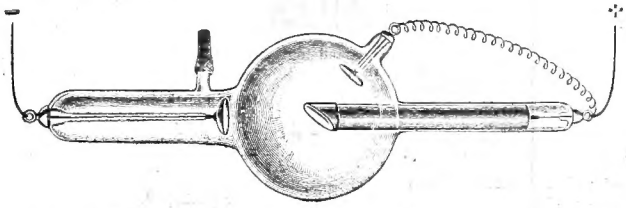

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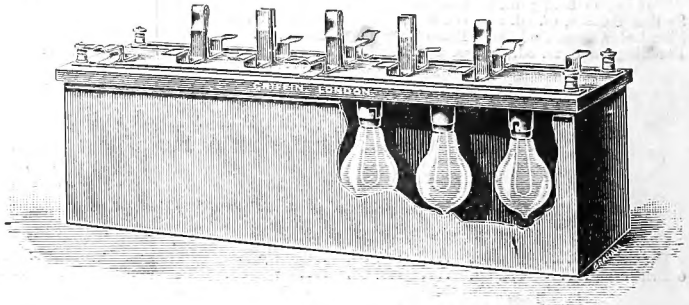

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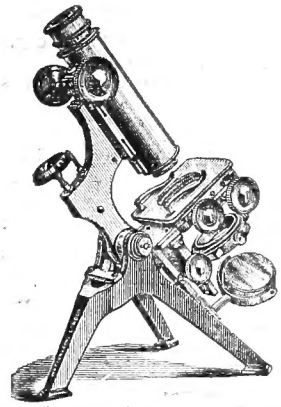

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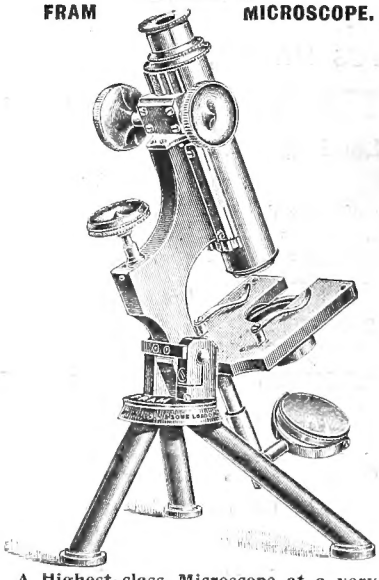

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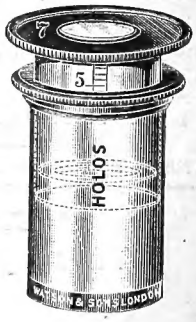

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